Total No. of Questions : 6]

SEAT No. :

P3713

[Total No. of Pages :2

Engg. - 24
T. E. (Electrical) (Semester-I)
POWER ELECTRONICS (In Sem.)
(2012 Pattern)

Time :1 Hour] *[Max. Marks :30*

Instructions to the candidates :

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) Draw and explain VI/Static characteristic of SCR. **[6]**

b) Define the following terms in SCR. **[4]**
   i) Forward break over voltage
   ii) Latching current
   iii) Holding current
   iv) I^2t rating

OR

Q2) a) Draw two transistor analogy of SCR and derive equation of anode current. **[6]**

b) What are the different turns on method of SCR? Explain any two. **[4]**

Q3) For fully controlled bridge converter with RL load without freewheeling diode

a) Draw circuit diagram **[1]**

b) Draw output voltage is waveform assuming inductor is sufficient to maintain constant current at firing angle 30° and 120° **[3]**

c) Derive average output voltage and current **[2]**

d) Derive rms output voltage and current **[2]**

e) Derive rectification efficiency and power factor **[2]**

OR

P.T.O.

Q4) a) Explain effect of source inductance on output voltage of converter. **[6]**

b) Explain difference between half wave converter, half controlled converter and fully controlled converter. **[4]**

Q5) a) Draw construction of TRIAC. Explain its four modes of operation. **[6]**

b) Draw circuit diagram of three phasefully controlled bridge converter. Also draw output voltage waveform for firing angle 0º and 60º. **[4]**

OR

Q6) For single phase AC voltage regulator with R load.

a) Draw circuit diagram **[1]**

b) Draw output voltage is waveform at firing angle 30º and 120º **[3]**

c) Derive average output voltage and current **[3]**

d) Derive rms output voltage and current **[3]**

Total No. of Questions : 6]

SEAT No. :

P5030

[Total No. of Pages : 2

TE / Insem - 528
T.E. (Electrical)
POWER ELECTRONICS
(2012 Pattern)

Time : 1 Hour] *[Max. Marks :30*

Instructions to the candidates:

1) *Solve Q.1 or Q.2 Q.3 or Q.4 Q.5 or Q.6.*
2) *Neat diagram must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Use of calculator is allowed.*
5) *Assume suitable data if necessary.*

Q1) a) Define latching and holding currents in the context of SCR. Show these currents on its static I -V characteristics. **[5]**

b) State the turn on methods of thyristor. Explain the method which is commonly used. **[5]**

OR

Q2) a) Explain the difference between an SCR and GTO. **[5]**

b) Explain the over current and thermal protection of SCR. **[5]**

Q3) a) Explain I phase fully controlled bridge converter with R load and draw output voltage waveforms for firing angle of 60 degrees. **[6]**

b) Derive the expression of output voltage of single phase fully controlled converter by taking into account the effect of source inductance. **[4]**

OR

Q4) a) Draw neat circuit diagram for a 1phase semi controlled converter feeding R-L load at $\alpha = 30°$. Draw output voltage waveform showing devices conducting during one cycle of input ac voltage. **[6]**

b) Draw neat circuit diagram and explain working of single phase fully controlled bridge converter feeding RL load with free wheeling diode **[4]**

P.T.O

Q5) For a 3 phase fully controlled bridge converter feeding resistive load

a) Draw neat circuit diagram **[1]**

b) Draw output voltage and current waveforms at $\alpha = 30°$ **[4]**

c) Write the switching sequence of SCRS clearly **[3]**

d) Derive expression for average output voltage **[2]**

OR

Q6) a) Explain application TRIAC as a light dimmer switch **[5]**

b) For a single phase full wave A.C. voltage regulator with R load

i) Draw circuit diagram **[1]**

ii) Draw output voltage waveform at firing angle 45 ° **[2]**

iii) Derive the formula for rms output voltage **[2]**

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Total No. of Questions : 6]

SEAT No. :

P5640

[Total No. of Pages : 2

TE/INSEM./OCT.-28
T.E. (Electrical)
POWER ELECTRONICS
(2012 Course) (303143) (Semester - I)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume suitable data, if necessary.***

UNIT - I

Q1) a) Compare the characteristics of an Ideal switch with Practical switch characteristics. **[5]**

b) Explain latching of SCR using two transistor analogy. How duration of gate pulse is decided? **[5]**

OR

Q2) a) Draw Dynamic characteristics of SCR and Explain turn on and turn off times. **[5]**

b) List various Protections used for SCR and Explain. **[5]**

UNIT - II

Q3) a) With help of a neat diagram and waveforms for output voltage and voltage across switch, explain the working of a single phase fully controlled bridge converter feeding RL load assuming continuous conduction. **[6]**

b) A single phase semi converter delivers power to RLE load with R = 5 ohm, L = 10mH and E = 80V. The ac supply voltage is 230V, 50Hz. For the continuous conduction, find the average value of output current for a firing angle of 50 deg. **[4]**

OR

Q4) a) With help of a neat diagram and waveforms explain the working of a single phase dual converter. **[5]**

b) A single phase full converter is supplied from 230 V, 50 Hz source having the source inductance of 0.1 mH. If average load current is 150 A. For a firing angle delay of 30 deg, find the average output voltage and the angle of overlap. **[5]**

P.T.O.

UNIT - III

Q5) a) For a three phase fully controlled bridge converter, derive average voltage expression for resistive load. What is the condition for continuous current. Draw the waveform. **[6]**

b) Explain four quadrant operation of TRIAC using neat diagram. **[4]**

OR

Q6) a) Explain working of single phase ac regulator feeding RL load. Draw output voltage waveform. **[5]**

b) A fully controlled 3 phase bridge converter is supplied from 200 V line voltage to feed highly inductive load with R = 10 ohm at firing angle of 45 degree. Calculate the average load voltage and average load current.**[5]**

Total No. of Questions : 10]

SEAT No. :

P2389

[Total No. of Pages :2

[4758] - 548
T.E. (Electrical)
POWER ELECTRONICS
(2012 Course) (End - Sem.) (Semester - I)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume Suitable data if necessary.***

Q1) a) What type of triggering is used in SCRs? Explain R & RC triggering. **[5]**

b) Explain characteristics of GTO. **[5]**

OR

Q2) a) Explain over voltage & over current protections for SCR. **[5]**

b) For 1ph full controlled bridge rectifier, calculate rectification efficiency, for Resistive load. **[5]**

Q3) a) Explain working of Triac as light dimmer switch. **[5]**

b) What is current source converter? Explain its operation. **[5]**

OR

Q4) Explain operation of 3ph half controlled bridge converter feeding RL load. Draw output voltage waveform for α = 30° & write output voltage expression. **[10]**

Q5) a) Draw VI chara. of MOSFET & explain its control. **[8]**

b) Draw step down chopper circuit & explain with expression for output voltage interms of control parameter. **[8]**

OR

P.T.O.

Q6) a) Explain VI chara. of MCT & give applications. **[8]**

b) A step down chopper feeding load with R = 10Ω and L = 5 mH from 220V supply at 500 Hz and 30% duty. Calculate average output voltage and av. current. Find I_{max} & I_{min} if % ripple is 10%. **[8]**

Q7) a) Explain 1ph. full bridge voltage source inverter. Derive output voltage expression for RL load. Draw relevant waveforms. **[8]**

b) Explain Sinusoidal PWM Technique for Inverters. Using 5 pulses /half cycle. Comment on harmonics in output voltage. **[8]**

OR

Q8) a) Explain working of 1ph full bridge inverter generating quasisquare wave in output, across inductive load. Draw waveform & explain. **[10]**

b) Explain Multiple pulse PWM used in inverters. What is its advantage over single pulse PWM? **[6]**

Q9) a) Explain 3ph. 120º mode conduction VSI operation with control signals & output phase voltage waveforms for 3ph. resistive star connected load. **[10]**

b) Explain voltage control & harmonic elimination techniques used in inverters. **[8]**

OR

Q10)a) Explain cascaded Multilevel inverter using 3H- bridges connected to V input supply. Draw output voltage waveforms. **[10]**

b) Compare: **[8]**

i) Multipulse and Multi level inverters.

ii) VSI & CSI.

Total No. of Questions : 10]

SEAT No. :

P2874

[Total No. of Pages :2

[4958]-1063
T.E.(Electrical)
POWER ELECTRONICS
(2012 Course)(Semester-I)(303143)

Time :2½Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Solve Q1 or 2,Q3or 4, Q5 or 6 , Q 7 or 8, Q 9 or 10.***
2) ***Assume suitable data if necessary.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of electronic calculator is allowed.***

Q1) a) Draw and explain static characteristic of SCR. **[5]**

b) Explain single phase ac voltage regulator feeding R load. Draw output voltage waveform. **[5]**

OR

Q2) a) Describe working of single phase two pulse SCR controlled converter with R load Draw waveforms of load voltage, load current. **[5]**

b) Explain V-I Characteristic of TRIAC in 1^{st} and III^{rd} quadrant. **[5]**

Q3) a) Explain method adopted for the protection of SCR against-dv/dt rate.**[3]**

b) Explain working of three phase fully controlled converter with output waveforms for firing angle of 60° with R load **[7]**

OR

Q4) a) Draw and explain single phase semi converter with output waveforms for RL load. **[5]**

b) A three phase half wave controlled converter is fed from 3 phase, 400V, and 50Hz source and is connected to a load taking a constant current. Calculate average value of load voltage for a firing angle of 30°&60°.**[5]**

P.T.O.

Q5) a) Explain four quadrant chopper feeding RLE load in detail with neat diagram. **[12]**

b) Give a comparison between MOSFET and IGBT **[4]**

OR

Q6) a) Explain Turn on and turn off process in MCT. State its merits. **[8]**

b) Draw a power circuit diagram for a type-A chopper. Show load voltage waveforms for $\alpha = 0.3$ and $\alpha = 0.8$. For both these duty cycles, calculate:

i) the average value of output voltage in terms of source voltage. **[8]**

Q7) a) Explain single phase full bridge inverter with necessary waveforms for R - L load. **[8]**

b) What is pulse width modulation? Explain sinusoidal PWM technique in detail. **[8]**

OR

Q8) a) Explain with circuit diagram and waveforms operation of single phase current source inverter. **[8]**

b) What are different voltage control methods for inverter? Explain any one type of control method. **[8]**

Q9) a) Explain working of three phase six step voltage source inverter in 180° mode of operation. For star connected balanced load draw output voltage waveforms. Show devices conducting in each step. **[12]**

b) What are different harmonic reduction techniques? Explain any two techniques. **[6]**

OR

Q10) a) What is multilevel inverter? Explain any one type in detail. **[6]**

b) Explain working of three phase six step voltage source inverter in 120°mode of operation. For star connected balanced load draw output voltage waveforms. Show devices conducting in each step. **[12]**

Total No. of Questions : 10]

SEAT No. :

P2587

[Total No. of Pages : 2

[5153]-563
T.E. (Electrical)
POWER ELECTRONICS
(2012 Pattern) (Semester-I)(EndSem.)

Time : 2½ Hours] *[Max. Marks :70*

Instructions to candidates:

1) ***Solve Questions 1 or 2, Question 3 or 4, Question 5 or 6, Question 7 or 8, Question 9 or 10.***
2) ***Assume Suitable data, if necessary.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***

Q1) a) Draw neat circuit diagram and explain working of single phase fully controlled bridge converter feeding RL load with Free Wheeling Diode. Draw waveforms of load voltage, load current. **[6]**

b) Explain the difference between SCR and GTO. **[4]**

OR

Q2) a) Draw neat circuit diagram for a 1 phase semi controlled converter feeding R-L load at α=60º. Draw output voltage waveform showing devices conducting during one cycle of input ac voltage. **[6]**

b) Draw a neat circuit diagram of a simple light dimmer circuit using Triac and draw the waveforms of voltage across the bulb and current passing through it for α=90º. **[4]**

Q3) For a 3 phase fully controlled Bridge converter feeding resistive load. **[10]**

a) Draw neat circuit diagram and explain working

b) Draw output voltage and current waveforms at α=60º

c) Write the switching sequence of SCRS clearly

d) Derive expression for average output voltage.

OR

Q4) a) Describe the RC full wave trigger circuit for one SCR when the load is AC. Draw related voltage waveforms. **[4]**

b) Explain with circuit diagram and waveforms working of 2 stage sequence control of AC regulator. **[6]**

P.T.O.

Q5) a) What is time ratio control in D.C. choppers? Explain the use of TRC for controlling the output voltage in choppers. **[8]**

b) Give comparison between MOSFET and IGBT **[8]**

OR

Q6) a) Explain with a diagram step-up chopper and derive the expression for the output voltage. A step up chopper with a pulse width of 150 μs is operating on 220 V dc supply. Compute the load voltage if the blocking period of the device is 40 μs. **[8]**

b) Explain output and Transfer characteristics of IGBT **[8]**

Q7) a) With a neat circuit diagram and necessary waveforms explain working of single phase full bridge voltage source inverter with inductive load. **[8]**

b) Why voltage control is needed in inverter circuits? State the various methods of voltage control in inverters circuits and explain any two methods. **[8]**

OR

Q8) a) With a neat circuit diagram explain the working of single phase capacitor commutated current source inverter with resistive load. Draw also the related voltage and current waveforms. **[8]**

b) Explain single pulse width modulation with diagrams. Derive an expression for output voltage. **[8]**

Q9) a) Explain working of three phase inverter in 120° mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. **[12]**

b) Compare Current Source Inverter and Voltage Source Inverter. **[6]**

OR

Q10)a) State the need of multilevel inverters. Explain the cascaded multilevel inverters with the help of neat circuit diagram and necessary waveform. **[12]**

b) Compare multilevel inverter with multi pulse inverter. **[6]**

Total No. of Questions : 10]

SEAT No. :

P 3290

[Total No. of Pages : 2

[5353] - 163
TE (Electrical)
POWER ELECTRONICS
(2012 Pattern)

Time : 2½ Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Solve questions 1 or 2 question 3 or 4 question 5 or 6, question 7 or 8, question 9 or 10.***
2) ***Assume suitable data, if necessary.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***

Q1) a) Draw Turn On characteristics of SCR and mark t_d, t_r, t_s On it. **[5]**

b) Explain in details TRIAC modes of operation. In which modes TRAIC is sensitive? **[5]**

OR

Q2) a) Draw neat circuit diagram for a 1 phase semi controlled converter feeding R-L load at $\alpha = 60°$. Draw output voltage waveform showing devices conducting during one cycle of input ac voltage **[5]**

b) Explain the difference between SCR and GTO. **[5]**

Q3) a) For a 3 phase fully controlled Bridge converter feeding resistive load

i) Draw neat circuit diagram **[2]**

ii) Write the switching sequence of SCRS clearly **[2]**

iii) State expression for average D.C. output voltage **[1]**

b) For single phase A.C. voltage regulator with R L load

i) Draw circuit diagram **[2]**

ii) Draw output voltage waveform at firing angle 60 ° **[2]**

iii) Write formula for rms output voltage **[1]**

OR

Q4) a) Draw neat circuit diagram and explain working of single phase fully controlled rectifier feeding RL load with Free Wheeling Diode **[5]**

P.T.O

b) For single phase A.C. voltage regulator with R load

i) Draw circuit diagram **[2]**

ii) Draw output voltage waveform at firing angle 60° **[2]**

iii) Write formula for rms output voltage **[1]**

Q5) a) Draw and explain switching characteristics of MOSFET. **[8]**

b) Explain voltage control strategies of chopper with waveforms. **[8]**

OR

Q6) a) Explain output and Transfer characteristics of IGBT **[8]**

b) A chopper is operating on TRC principle at a frequency of 2 kHz on a 220 volt D.C. supply. If the load voltage is 170 volt, compute conduction and blocking period of thyristor in each cycle. **[8]**

Q7) a) Explain with neat circuit diagram single phase full bridge voltage source inverter and draw output voltage waveforms **[8]**

b) Explain Multiple pulse PWM technique for single phase VSI **[8]**

OR

Q8) a) Explain with neat circuit diagram single phase half bridge voltage source inverter and draw output voltage waveforms **[8]**

b) Explain sinusoidal pulse PWM technique for single phase VSI **[8]**

Q9) a) Explain working of three phase inverter in 120° mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. **[12]**

b) Compare between 120 deg and 180 deg mode of operation of 3 phase inverters. **[6]**

OR

Q10)a) Explain the concept of multilevel inverter. State its different types. **[6]**

b) Draw Cascaded bridge Multilevel inverter and explain its working. State applications. **[12]**

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Total No. of Questions :10]

SEAT No. :

P3513

[Total No. of Pages : 2

[5560]-163
T.E. (Electrical)
POWER ELECTRONICS
(2012 Course) (Semester-I)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer any one question from Q1 & Q2, Q3 & Q4, Q5 & Q6, Q7 & Q8, Q9 & Q10.***
2) ***Figures to the right indicate full marks.***

Q1) a) What are different methods of triggering of SCR? Explain RC triggering method. **[5]**

b) Describe the working of single phase half controlled converter with RLE load. Draw neat circuit diagram, and waveforms for

i) Output voltage ii) Output current. **[5]**

OR

Q2) a) Explain gate characteristics of SCR during Turn on. **[5]**

b) Explain working of single phase AC voltage regulator with RL load. **[5]**

Q3) a) Draw V-I characteristics of TRIAC & explain four mode operation of TRIAC. **[5]**

b) What is a dual converter? Explain working of single phase dual converter with suitable diagram to give 4 quadrant operation of a motor. **[5]**

OR

Q4) a) Explain working of a three phase fully controlled bridge rectifier feeding highly inductive load with help of neat circuit diagram. What is the boundary of discontinuous conduction? Write expression of average output voltage. **[5]**

b) A single phase full wave rectifier connected to 230 V, 50 Hz source, is feeding a load of $R = 10\,\Omega$ in series with a large inductance that makes a load current ripple free. For a firing angle of 45°, determine **[5]**

i) Output voltage

ii) Output power

iii) Form Factor

iv) Ripple Factor.

P.T.O.

Q5) a) Draw and explain switching characteristics of MOSFET. **[8]**

b) Explain operation of four quadrant chopper. **[8]**

OR

Q6) a) Explain with neat diagram working of a step up chopper feeding an inductive load. Draw output voltage and current waveforms. Derive average and rms output voltages equations in terms of duty cycle. **[10]**

b) A step-up chopper has input voltage of 220 V and output of 660 V. If the conduction time of chopper is 120 μ sec, compute the pulse width of output voltage. If the output voltage pulse width is increased to there times its previous width for constant frequency operation, find the average output voltage. **[6]**

Q7) a) Explain with neat circuit diagram and waveforms the operation of single phase current source inverter feeding RL load. **[8]**

b) Give comparison between voltage source inverter and current source inverter. **[8]**

OR

Q8) a) Explain multiple pulse width modulation with necessary waveforms.**[8]**

b) How inverters are classified? What are the external and internal voltage control methods in inverter? **[8]**

Q9) a) Draw the circuit diagram of three phase inverter feeding resistive load (star connected) using 120° conduction mode. Draw the switching sequence of the devices and waveforms of output phase and line voltages. **[10]**

b) Compare multilevel inverter with Multi pulse Inverter. **[8]**

OR

Q10) a) What are the types of Multilevel Inverter? Explain cascaded multilevel inverter. **[10]**

b) What is the necessity of controlling the voltage at the output terminals of the inverter? Explain briefly the various methods employed for the control of output voltage of inverters. **[8]**

[4658] – 543

Seat No.	

T.E. (Electrical)(Semester – I) Examination, 2014
POWER ELECTRONICS
(2012 Course)

Time : 3 Hours Max. Marks : 70

1. a) For SCR, account for switching losses and effect of switching frequency on power loss. **5**
   b) Explain 'dynamic chara' of SCR. **5**

OR

2. a) Explain single phase dual converter with circulating current mode. **5**
   b) Explain single phase ac regulator feeding RL load. Draw output voltage waveform. **5**

3. a) Compare output voltages available from 1ph and 3 ph. fully controlled bridge rectifiers based on magnitude, ripple content and ripple frequency. **5**
   b) Explain use of diode as FWD and feedback diode for inductive loads. **5**

OR

4. a) Draw and explain gate chara of SCR. **5**
   b) Explain 3 ph. semicontrolled rectifier feeding RL load. Write output voltage expression. **5**

5. a) Explain Type C chopper operation with circuit diagram and waveforms. **8**
   b) Compare MOSFET, IGBT and power transistor with neat symbols and SOAs **8**

OR

6. a) Draw VI chara of MCT and explain operation. **8**
   b) For a chopper feeding inductive load with R = 4 Ω & L = 6 mH from 200 V source at 50% duty and 1kH_2 switching frequency, find
      i) Maxi and Mini load current
      ii) Peak to Peak ripple current
      iii) Av. voltage and Av. load current.

7. a) Explain working of 1ph bridge inverter feeding RL load. Draw voltage and current waveforms and comment on need for feedback diodes. **8**
   b) Explain multiple pulse width Modulation Technique for Inverter control. Explain modulation indices and effect on harmonic control. **8**

OR

8. a) Explain why quasi square output voltage has better performance than square wave output. How 1ph. inverter bridge can be operated to give quasi square output ? **8**
   b) Explain sinusoidal PWM technique for inverters. How voltage and freq. control is achieved ? **8**

P.T.O.

9. a) Draw 3 ph inverter bridge to feed 3 ph resistive load (star connected) using 180° mode of conduction. Draw control signals for devices used and output phase and line voltage. **10**

   b) Compare CSI and USI based on working and advantages. **8**

OR

10. a) What is the need of using multilevel inverters ? Explain one type of multilevel inverter. **10**

    b) Compare and comment on Multipulse and Multilevel inverter output voltages. **8**

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Total No. of Questions : 10]

SEAT No. :

P1326

[Total No. of Pages : 3

[4858] - 1063
T.E. (Electrical)
Power Electronics
(2012 Pattern) (End Sem.)

Time : $2\frac{1}{2}$ *Hours]* *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Describe the gate triggering of a thyristor. Does the gate current have any effect on the forward break over voltage. Discuss. **[5]**

b) Define latching and holding current as applicable to an SCR. Show these currents on its static IV characteristics. **[5]**

OR

Q2) a) Sketch switching (or dynamic) characteristics of a thyristor during its turn on and turn off processes. Show the variation of voltage across the thyristor and current through it with respect to time during these two dynamic processes. Write expressions for turn on time and turn off time. **[8]**

b) Discuss the conditions which must be satisfied for turning on an SCR with a gate signal. **[2]**

Q3) A single phase half wave SCR circuit feeds power to a resistive load. Draw waveforms for source voltage, load voltage, load current, and voltage across the SCR for a given firing angle α. Hence obtain expressions for average and rms load voltages in terms of source voltage and firing angle. **[10]**

OR

P.T.O.

Q4) a) For a 3 phase full converter, explain how output voltage wave, for firing angle 60º is obtained by using **[5]**

i) phase voltages and

ii) line voltages.

b) Discuss the effect of source inductance on the performance of a single-phase full converter indicating clearly the conduction of various thyristors during one cycle. **[5]**

Q5) a) Describe the principle of step-up chopper. Derive an expression for the average output voltage in terms of input voltage and duty cycle. State the assumptions made. **[10]**

b) A step up chopper has input voltage of 220V and output voltage of 660V. If the conducting time of thyristor chopper is $100\mu s$, compute the pulse width of output voltage. Draw circuit diagram. **[6]**

OR

Q6) a) Explain switching characteristics of an IGBT. **[8]**

b) Compare power of MOSFETs with BJTs. **[8]**

Q7) a) Draw neat circuit and describe the working of a single phase full bridge inverter feeding Inductive load with square wave output. Draw output voltage and current waveforms to show conduction intervals of devices. Comment on drawback of square output voltage. **[8]**

b) The single phase half-bridge inverter has a resistive load of $R = 2.4\Omega$ and the dc input voltage is $V_s = 48V$. Determine **[8]**

i) the rms output voltage.

ii) the output power P_o,

iii) the average and peak currents of each transistor,

iv) the peak reverse blocking voltage V_{BR} of each transistor,

OR

Q8) a) What are the main differences between voltage source and current source inverters. Explain current source inverter in detail with neat circuit diagram. **[8]**

b) Explain sinusoidal - pulse width modulation as used in PWM inverter. What are modulation indices? How they affect output voltage? Discuss the effect of number of pulses generated per half cycle on harmonics in output voltage. **[8]**

Q9) a) Draw and explain working of 3ph inverter bridge to feed 3ph resistive load (star connected) using 120° mode of conduction. Draw control signals for devices used and output phase and line voltage. **[10]**

b) Draw a single phase CSI is fitted with ideal SCRs. Describe its working when its load is a inductive. Show output current and voltage waveforms. **[8]**

OR

Q10) a) What are the types of Multilevel Inverter. Explain diode clamped multilevel inverter. **[10]**

b) What is a cascaded multilevel inverter? What are the advantages of a cascaded multilevel inverter. **[8]**

Total No. of Questions : 10]

SEAT No. :

P1710

[Total No. of Pages : 2

[5058]-343
T.E. (Electrical)
POWER ELECTRONICS
(2012 Course) (Semester - I)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***

Q1) a) Describe working of single phase bridge converter with R load Draw waveforms of load voltage, load current. **[5]**

b) How ac voltage regulators are classified? Explain single phase ac regulator feeding inductive load. Draw output voltage waveform. **[5]**

OR

Q2) a) Draw & Explain Gate Characteristic of SCR. **[5]**

b) Explain the following ratings of the thyristor. **[5]**

i) Latching current

ii) Holding current

Q3) a) Explain working of three phase full converter with a firing angle of 30^{o} & obtain expression for phase voltage & Line voltage. **[5]**

b) State and explain the effect of source inductance on operation of converter. **[5]**

OR

Q4) a) Draw and explain single phase semi converter with output waveforms with RL load. **[5]**

b) Explain R-C triggering circuit of Thyristor. **[5]**

Q5) a) Explain Class E chopper feeding RLE load in detail. **[8]**

b) Describe the basic structure of MCT. Give its equivalent circuit and explain the turn on and turn off process. **[8]**

OR

P.T.O.

Q6) a) What is time ratio control in dc choppers? Explain the use of TRC for controlling the output voltage in choppers. **[8]**

b) For Type A chopper the supply voltage is 230V, load resistance being 10Ω for the duty cycle of 40%. Find the average and rms values of the output voltage and chopper efficiency by taking voltage drop of 2V across the chopper during ON condition. **[8]**

Q7) a) Explain with circuit diagram and waveforms operation of single phase current source inverter. **[8]**

b) Explain Sinusoidal Pulse width modulation with necessary waveforms. **[8]**

OR

Q8) a) Explain with circuit diagram and waveforms operation of single phase current source inverter. **[8]**

b) Derive expression for output voltage in single pulse Modulation by Fourier analysis. **[8]**

Q9) a) Explain working of three phase six step voltage source inverter in 120^o mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. **[10]**

b) Compare Multilevel inverter and Multi Pulse Inverter. **[8]**

OR

Q10)a) Draw neat diagram and explain cascaded multilevel inverter. **[8]**

b) Explain working of three phase six step voltage source inverter in 180^o mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. **[10]**

Total No. of Questions : 10]

SEAT No. :

P2440

[Total No. of Pages : 2

[5253] - 163
T.E. (Electrical)
POWER ELECTRONICS
(2012 Pattern) (Semester - I)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) ***Solve Questions 1 or 2, Question 3 or 4,Question 5 or 6, Question 7 or 8, Question 9 or 10***
2) ***Assume suitable data, if necessary.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***

Q1) a) Describe working of single phase semi converter with RL load. Draw waveforms of load voltage, load current. **[5]**

b) Draw and explain Gate characteristic of SCR. **[5]**

OR

Q2) a) Explain single phase ac regulator feeding inductive load. Draw output voltage waveform. **[5]**

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 delay of 45° determine- **[5]**

i) Average output voltage

ii) Average output current.

Q3) a) Write a short note on rectification and inversion mode of operation of single phase controlled converter. **[5]**

b) Explain R-C triggering circuit of Thyristor. **[5]**

OR

Q4) a) Explain working of three phase half wave converter connected to resistive load with a firing angle of 60° & draw waveforms of phase voltage & phase current **[5]**

b) With neat constructional diagram explain working of GTO. **[5]**

P.T.O.

Q5) a) Draw and explain output and transfer characteristics of MOSFET. **[8]**

b) For a type A chopper circuit, source voltage Vs =220V, chopping period, T= 2000 μs, on period = 600 μs, load circuit parameters: R= 1Ω, L=5mH and E= 24V. **[8]**

i) Find average output voltage.

ii) Find average output current

iii) Calculate the maximum and minimum values of steady state output current.

OR

Q6) a) Explain Class E chopper feeding RLE load in detail. **[8]**

b) What is time ratio control in dc choppers? Explain the use of TRC for controlling the output voltage in choppers. **[8]**

Q7) a) Explain working of single phase full bridge inverter. Draw all waveforms. **[8]**

b) Explain Sinusoidal Pulse width modulation with necessary waveforms. How voltage and frequency control is achieved. **[8]**

OR

Q8) a) Explain with circuit diagram and waveforms operation of single phase current source inverter. **[8]**

b) Explain single pulse width modulation with quasi square wave output & analyze the output with Fourier analysis. How harmonics in the output voltage is controlled by varying the width of pulse. **[8]**

Q9) a) Compare multilevel inverter with multi pulse inverter. **[8]**

b) Explain working of three phase six step voltage source inverter in 180° mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. **[10]**

OR

Q10)a) Explain working of three phase six step voltage source inverter in 180° mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. **[10]**

b) What are the techniques used for control of harmonics in output voltage of inverter? Explain any two techniques in detail. **[8]**

Total No. of Questions : 10]

SEAT No. :

P1487

[Total No. of Pages : 2

[5460]-163
T.E. (Electrical)
POWER ELECTRONICS
(2012 Course) (Semester - I) (End Semester)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to candidates:

1) ***Solve questions Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8 and Q9 or Q10.***
2) ***Assume suitable data, if necessary.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***

Q1) a) Explain gate characteristics of SCR. **[5]**

b) Describe the working of single phase half controlled converter with RLE load. Draw neat circuit diagram, and waveforms for **[5]**

i) Output voltage.

ii) Output current.

OR

Q2) a) What are different methods of triggering of SCR? Explain UJT triggering method. **[5]**

b) Explain working of single phase AC voltage regulator with resistive load. **[5]**

Q3) a) Draw V-I characteristics of TRIAC & explain how it can be used as voltage regulator with suitable example. **[5]**

b) Explain working of a three phase fully controlled bridge rectifier feeding highly inductive load with help of neat circuit diagram. What is the boundary of discontinuous conduction? Write expression of average output voltage. **[5]**

OR

Q4) a) What is a dual converter? Explain working of Single phase dual converter with suitable diagram to give 4 quadrant operation of a motor. **[5]**

b) A single phase supply of 230 V, 50 Hz is to deliver power to a load of R = 10Ω through a half wave controlled rectifier. For a firing angle of 60°, determine : **[5]**

i) The rectification efficiency.

ii) Form Factor.

iii) Ripple Factor.

P.T.O.

Q5) a) Draw and explain switching characteristics of IGBT. **[8]**

b) Explain the control strategies used in dc choppers to control output voltage. What are the drawbacks of FM control? **[8]**

OR

Q6) a) Explain with neat diagram working of a step up chopper feeding an inductive load. Draw output voltage and current waveforms. Derive average and rms output voltages equations in terms of duty cycle. **[10]**

b) A step –up chopper has input voltage of 220 V and output of 660 V. If the conduction time of chopper is 100 μsec, compute the pulse width of output voltage. If the output voltage pulse width is halved for constant frequency operation, find the average value of new output voltage. **[6]**

Q7) a) Explain with neat circuit diagram and waveforms the operation of single phase voltage source inverter feeding RL load. **[8]**

b) Explain multiple pulse width modulation technique for inverter control. Explain modulation indices and effect on harmonic control. **[8]**

OR

Q8) a) How inverters are classified? What are the external and internal voltage control methods in inverter? **[8]**

b) Explain sinusoidal pulse width modulation with necessary waveforms. **[8]**

Q9) a) Draw the circuit diagram of three phase inverter feeding resistive load (star connected) using 180º conduction mode. Draw the switching sequence of the devices and waveforms of output phase and line voltages. **[10]**

b) What is the necessity of controlling the voltage at the output terminals of the inverter? Explain briefly the various methods employed for the control of output voltage of inverters. **[8]**

OR

Q10)a) What are the types of Multilevel Inverter? Explain cascaded multilevel inverter. **[10]**

b) Compare Multilevel inverter with Multi pulse Inverter. **[8]**

Total No. of Questions : 06]

SEAT No. :

P19

[Total No. of Pages : 2

Oct.-16/TE/Insem. - 18
T.E. (Electrical)
Power Electronics
(2012 Pattern) (Semester-I)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Solve Q.l or Q.2, Q.3 or Q.4, Q.5 or Q.6.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) Draw switching characteristics of SCR and explain reverse recovery phenomenon. **[6]**

b) Explain latching of SCR using two transistor analog. **[4]**

OR

Q2) a) What are the turn on methods of SCR? Which is the most preferred method? Why? **[5]**

b) Explain with a diagram U JT triggering method of SCR. **[5]**

Q3) a) Explain with circuit diagram and output waveforms, working of single phase half wave controlled rectifier feeding RL load with Free Wheeling Diode(FWD). **[5]**

b) Explain with circuit diagram and output waveforms working of single phase fully controlled bridge converter feeding RLE load. **[5]**

OR

Q4) a) Explain single phase dual converter with circulating current mode. State the disadvantages of circulating current. **[5]**

b) Explain the concept of overlap angle and associated voltage drop in single phase converter with RL load. **[5]**

P.T.O.

Q5) a) For a three phase fully controlled bridge converter, draw circuit diagram and output waveforms for $\alpha = 60°$ for R load and write the expression for average output voltage. **[5]**

b) Explain the operation of TRIAC in all the four modes. **[5]**

OR

Q6) a) For a three phase semi converter draw circuit diagram and output waveforms for R load and write the expression for average output voltage. **[6]**

b) For single phase AC voltage regulator with RL load **[4]**

i) Draw circuit diagram

ii) Draw output voltage waveform for firing angle of 120°

✦ ✦ ✦ ✦

Total No. of Questions : 6]

SEAT No. :

P5080

[Total No. of Pages : 2

T.E./Insem.-628
T.E. (Electrical)
POWER ELECTRONICS
(2015 Pattern)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) Describe the different modes of operation of SCR with the help of V-I characteristic. **[5]**

b) Explain the following specifications of the thyristor. **[5]**

i) dv/dt.

ii) di/dt.

iii) I^2t.

OR

Q2) a) Explain the full wave R-C triggering circuit of Thyristor with the help of neat circuit diagram and output waveforms. **[6]**

b) Why is the reverse breakdown voltage greater than the forward breakdown voltage in SCR? **[4]**

Q3) a) Draw and explain the switching characteristics of IGBT. **[5]**

b) What is duty cycle of chopper and explain PWM & FM techniques of voltage control. **[5]**

OR

P.T.O.

Q4) a) Compare between Power MOSFET and BJT. **[4]**

b) Write short note on Class E Chopper. **[6]**

Q5) a) Explain the working of single phase semi converter bridge with RL load. Derive the expression for output voltage. **[5]**

b) With neat diagram explain the concept of overlap angle. Write formula to calculate voltage drop due to overlap. **[5]**

OR

Q6) a) Write short note on single phase dual converter. **[5]**

b) Derive expression for average output voltage and rms output voltage of a single phase fully controlled bridge converter with RL load (Assume continuous conduction). **[5]**

Total No. of Questions : 6]

SEAT No. : [ ]

P5684

[Total No. of Pages : 2

TE/INSEM/OCT.-130
T.E. (Electrical)
POWER ELECTRONICS
(2015 Course) (Semester-1)

Time : 1 Hour] ***[Max. Marks : 30***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3, or Q4, Q5 or Q6.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Explain dynamic Characteristics of SCR during its turn on process. Show the variation of voltage across the SCR and current through it with respect to time during this dynamic process. **[6]**

b) Explain the need of commutation in thyristor circuits. Explain Class D Commutation. **[4]**

OR

Q2) a) Explain working of GTO and specify its applications. **[6]**

b) Explain overvoltage and over current protections for SCR. **[4]**

Q3) a) Describe the principle of step up chopper. Derive an expression for the average output voltage in terms of the input voltage and duty cycle. State the assumptions made. **[6]**

b) Explain switching characteristics of MOSFET. **[4]**

OR

Q4) a) Explain the control strategies used in dc choppers to control output voltage. What are the drawbacks of FM control? **[6]**

b) The step up chopper has input voltage of 200 V and output voltage of 600 V. The conduction time of the thyristor chopper is 200 µsec. Calculate: **[4]**

i) Chopping Frequency

ii) If pulse width is reduced to half for constant frequency of operation, find new output voltage.

P.T.O.

Q5) Draw a neat circuit diagram for a single phase semi controlled converter feeding a highly inductive load from single phase ac supply at firing angle of 45°.**[10]**

a) Draw waveforms for output voltage and current.

b) Currents carried by controlled and uncontrolled devices.

c) Write expression for average output voltage and current.

d) Write expression for rms output voltage and current

OR

Q6) a) Explain the effect of source inductance on the operation of 1 phase fully controlled converter and the concept of overlap angle. **[6]**

b) A single phase fully controlled bridge converter is fed from 230V, 50 Hz supply and delivering power to the resistance of 10 Ω in series with a large smoothing inductor. Find out the following for firing angle of 45°.**[4]**

i) $V_{0\ (av)}$

ii) $V_{0\ (rms)}$

iii) Form Factor

iv) Ripple Factor

Total No. of Questions : 10]

SEAT No. :

P3369

[Total No. of Pages : 3

[5353] - 563

TE. (Electrical)

POWER ELECTRONICS

(2015 Pattern)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q8, Q.9 or Q.10***
2) ***Assume suitable data, if necessary.***
3) ***Neat diagrams must be drawn wherever necessary..***
4) ***Figures to the right indicate full marks.***

Q1) a) Explain the triggering of SCR using UJT relaxation oscillator. **[5]**

b) Draw neat circuit diagram and explain working of single phase fully controlled bridge converter feeding RL load with freewheeling diode. **[5]**

OR

Q2) a) Draw the circuit symbol and VI characteristics of GTO **[4]**

b) Draw neat circuit diagram of a 1 phase semi controlled converter feeding R-L load at $\alpha = 90°$. Draw output voltage waveform showing devices conducting during one cycle of input ac voltage **[6]**

Q3) a) Describe the principle of step up chopper. Derive an expression for the average output voltage in terms of input voltage and duty cycle. State the assumptions made. **[6]**

b) Compare between MOSFET and BJT. **[4]**

OR

Q4) a) A step up chopper with a pulse width of 100 µs is operating from 230 V DC Supply. Compute the average value of load voltage for a chopping frequency of 2000 Hz. **[4]**

P.T.O.

b) For a single phase fully controlled bridge converter with R load

i) Draw circuit diagram **[2]**

ii) Draw output voltage waveform at firing angle 60 ° **[3]**

iii) Write formula for average DC voltage **[1]**

Q5) a) For a 3 phase fully controlled bridge converter feeding resistive load

i) Draw neat circuit diagram **[2]**

ii) Draw output voltage and current waveforms at $\alpha = 30°$ **[4]**

iii) Write the switching sequence of SCRS clearly **[2]**

iv) Derive expression for average output voltage **[2]**

b) Explain triggering of TRAIC using DIAC with neat circuit diagram **[6]**

OR

Q6) a) For a 3 phase fully controlled bridge converter feeding RL load

i) Draw neat circuit diagram **[2]**

ii) Draw output voltage waveform at $\alpha=90°$ **[4]**

iii) Write the switching sequence of SCRS clearly **[2]**

b) Explain working of single phase AC voltage regulator with R Load . Draw output voltage and current waveforms. **[8]**

Q7) a) Explain with neat circuit diagram and waveforms single phase full bridge voltage source inverter with R load. **[8]**

b) Compare Current Source Inverter and Voltage Source Inverter. **[8]**

OR

Q8) a) Explain sinusoidal pulse PWM technique with waveforms **[8]**

b) Explain working of Current source inverter with ideal switches **[8]**

Q9) a) Explain working of three phase inverter in 180° mode of operation. For star connected load, draw output line and phase voltage waveforms. Show devices conducting in each step. **[10]**

b) Draw neat diagram for Diode Clamped multilevel converter and explain its working with the help of Switching states of devices. Draw Output Phase voltage waveform. **[8]**

OR

Q10)a) State the methods for voltage control of inverters and explain any one method in detail. **[8]**

b) Draw circuit diagram for three level Flying capacitor Converter and explain its principal of operation. Comment on voltage balancing of capacitors. **[10]**

Total No. of Questions :10]

SEAT No. :

P3608

[Total No. of Pages : 2

[5560]-563
T.E. (Electrical)
POWER ELECTRONICS
(2015 Pattern) (Semester - I)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer any one questions from Q1 & Q2, Q3 & Q4, Q5 &Q6, Q7 &Q8, Q9 & Q10***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Black figures to the right indicate full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) Explain with neat circuit diagram operation of R-C triggering circuit of Thyristor **[5]**

b) Write short note on Class E Chopper. **[5]**

OR

Q2) a) Describe working of single phase semi converter with RL load. Draw weveforms of load voltage, load current. **[5]**

b) Draw and explain output and transfer characteristics of MOSFET **[5]**

Q3) a) Describe working of single phase circulating type of dual converter with output voltage waveform. **[5]**

b) State and explain different modes of operation of SCR with the help of V-I characteristic. **[5]**

OR

Q4) a) Explain the following ratings of the thyristor.

i) Latching current

ii) Holding current **[5]**

b) For a type A chopper circuit, source voltage Vs = 220V, chopping period, T=2000 μs , on period =600 μs , load circuit parameters: $R = 1\Omega, L = 5mH$ and E=24V. Calculate the maximum and minimum values of steady state output current. **[5]**

P.T.O.

Q5) a) With neat diagram explain four mode operation of a TRIAC. **[8]**

b) Explain working of three phase fully controlled converter with RL load & firing angle of 30^0. Draw output voltage waveforms & obtain expression for phase voltage & Line voltage. **[8]**

OR

Q6) a) A three phase full converter operating from three phase, 415V, 50Hz supply with resistive load, Determine average output voltage for $\alpha = 30^o$ and $\alpha = 90^o$. **[8]**

b) What is two stage ac voltage regulator? Explain its operation with output waveform for RL Load. **[8]**

Q7) a) For single pulse width modulation with quasi square wave show that output voltage can be expressed as $V0=\sum_{n=1,3,5,.....}^{\infty} \frac{4Vs}{n\pi}\sin\frac{n\pi}{2}$ sinnd sinnwt. Where Vs is source voltage and pulse width is 2d. **[8]**

b) Explain with circuit diagram and waveforms operation of single phase current source inverter. **[8]**

OR

Q8) a) Explain Sinusoidal Pulse width modulation with necessary waveforms. **[8]**

b) A single phase full bridge inverter is operated from 48V battery and is supplying power to a pure resistive load of 10Ω .Determine **[8]**

i) Output voltage (rms voltage)

ii) Output rms power

Q9) a) List different harmonic elimination techniques used in inverter. Explain any two methods in detail. **[10]**

b) Draw a neat diagram and explain cascaded multi level converter. **[8]**

OR

Q10)a) Explain working of three phase six step voltage source inverter in 180^o mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. **[10]**

b) Write short note on Flying Capacitor multilevel converter. **[8]**

Total No. of Questions : 10]

SEAT No. : ____

P2504

[Total No. of Pages : 2

[5253] - 529
T.E. (Electrical)
Power Electronics
(2015 Pattern) (End Sem.)

Time : 2½ Hours] ***[Max. Marks :70***

Instructions to the candidates:

1) ***Solve Questions 1 or 2, Question 3 or 4, Question 5 or 6, Question 7 or 8, Question 9 or 10.***
2) ***Assume suitable data, if necessary.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***

Q1) a) Elaborate effect of source inductance on the performance of single phase fully controlled converter. **[5]**

b) With neat constructional diagram explain working of GTO. **[5]**

OR

Q2) a) What is time ratio control in dc choppers? Explain the use of TRC for controlling the output voltage in choppers. **[5]**

b) Draw turn on characteristic of thyristor and define delay time and rise time. **[5]**

Q3) a) A single phase half controlled bridge converter feeds a load comprising of a resistance of 10 ohm and a large inductance to provide a constant and ripple free current. Calculate the average value of output voltage and current. Firing angle is 45° and input ac voltage is 120V, 50Hz. **[5]**

b) Draw and explain output and transfer characteristics of MOSFET. **[5]**

OR

Q4) a) Compare MOSFET and IGBT. **[5]**

b) Write a short note on necessity of input filter. **[5]**

P.T.O.

Q5) a) A three phase half wave controlled converter is fed from 3 phase, 400V, 50Hz source and is connected to a resistive load of 10 ohm per phase. Calculate the average value of load voltage and current for a firing angle of 30° and 60°. **[8]**

b) Explain single phase ac regulator feeding inductive load. Draw output voltage waveform and derive equation for rms output voltage. **[8]**

OR

Q6) a) With neat diagram explain four mode operation of a TRIAC. **[8]**

b) Draw and explain three phase semi converter feeding RL load with output wave forms. **[8]**

Q7) a) Explain working of single phase full bridge voltage source inverter. Draw all waveforms. **[8]**

b) For single pulse width modulation with quasi square wave show that output voltage can be expressed as $V_0 = \sum_{n=1,3,5,....}^{\infty} \frac{4Vs}{n\pi} \sin \frac{n\pi}{2}$ sinnd sinnwt.Where Vs is source voltage and pulse width is 2d. **[8]**

OR

Q8) a) Explain sinusoidal pulse width modulation as used in PWM inverters. Write important features of the same. **[8]**

b) Explain with circuit diagram and waveforms, operation of single phase current source inverter. **[8]**

Q9) a) List different harmonic elimination techniques used in inverter. Explain any two methods in detail. **[8]**

b) Explain working of three phase six step voltage source inverter in 180° mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. **[10]**

OR

Q10)a) Explain working of three phase six step voltage source inverter in 120° mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. **[10]**

b) Draw a neat diagram and explain cascaded multilevel converter. **[8]**

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Total No. of Questions : 10]

SEAT No. :

P1734

[Total No. of Pages : 3

[5460] - 563
T.E. (Electrical)
POWER ELECTRONICS
(2015 Pattern) (Semester - I)

Time : 2½ Hours] *[Max. Marks :70*

Instructions to the candidates:

1) *Answer any one question from Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data if necessary.*

Q1) a) What is communication of SCR? Explain class C communication of SCR. **[5]**

b) Explain the working of type D chopper with appropriate waveforms to demonstrate its operation in first and fourth quadrants. Indicate the range of duty cycle for which it operates in first and fourth quadrants. **[5]**

OR

Q2) a) Derive expression for average output voltage and rms output voltage of a single phase fully controlled bridge converter feeding RL load. (assume continuous conduction) **[5]**

b) Draw and explain output and transfer characteristics of IGBT. **[5]**

Q3) a) Describe working of single phase of dual converter with output voltage waveform. **[5]**

b) Explain working of SCR. Define latching current & holding current as applicable to an SCR. Show these currents on its static V-I Characteristics. **[5]**

OR

P.T.O.

Q4) a) Explain with neat circuit diagram operation of UJT triggering circuit of Thyristor. **[5]**

b) For a type A chopper, DC source voltage Vs = 230 V, load resistance R = 10 Ω. Take a voltage drop of 2V across chopper when it is on. For duty cycle of 0.4, calculate : **[5]**

i) Average and rms values of output voltage.

ii) Chopper efficiency

Q5) a) Explain working of three phase fully controlled converter with RL load & firing angle of 60° Draw output voltage waveforms & obtain expression for phase voltage & Line voltage. **[8]**

b) With neat diagram explain four mode operation of a TRIAC. **[8]**

OR

Q6) a) Explain operation of two stage ac voltage regulator with out put waveforms for RL load. **[8]**

b) A 3 phase full converter, fed from three phase, 400 V, 50 Hz source is connected to load R = 10Ω , E = 350 V and large inductance so that the output current is ripple free. Calculate the power delivered to load and input power factor for $\alpha = 30°$ **[8]**

Q7) a) For single pulse width modulation with quasi square wave show that output voltage can be expressed as $V0=\sum_{n=1,3,5,....}^{\infty} \frac{4Vs}{n\pi}\sin\frac{n\pi}{2}\sin nd\sin nwt$. Where Vs is source voltage and pulse width is 2d. **[8]**

b) Explain with neat circuit diagram working of single phase full bridge voltage source inverter connected to R, RL, RLC load and draw output voltage and current waveforms. **[8]**

OR

Q8) a) Explain Multiple pulse modulation with necessary waveforms. Why multiple pulse modulation is better than single pulse modulation? **[8]**

b) Compare current source inverter and voltage source inverter. **[8]**

Q9) a) Draw neat diagram of three level Flying capacitor converter and explain its principal of operation. Comment on voltage balancing of capacitors. **[10]**

b) List different harmonic elimination techniques used in inverter. Explain any one method in detail. **[8]**

OR

Q10) a) Explain working of three phase six step voltage source inverter in 120° mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. **[10]**

b) Write short note on cascaded multilevel converter. **[8]**

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Total No. of Questions : 10] **SEAT No. :**

P2944 **[Total No. of Pages : 2**

[5669]-533
T.E. (Electrical)
POWER ELECTRONICS
(2015 Pattern) (Semester - I)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, and Q9 or Q10.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) Draw and explain switching characteristics of SCR. **[6]**

b) Explain operation of step down chopper with input voltage, output voltage and output current waveforms. **[4]**

OR

Q2) a) Describe briefly over voltage, over current and thermal protection of thyristor. **[6]**

b) Write a short note on class C chopper. **[4]**

Q3 a) Draw and explain output and transfer characteristics of IGBT. **[4]**

b) Derive the expression for average and RMS output voltage of a single phase semi-converter. **[6]**

OR

Q4) a) Draw and explain output and transfer characteristits of MOSFET. **[4]**

b) A single phase fully controlled bridge rectifier is operated with resistive load of 15 Ω, the input voltage is 230V. For the firing angle $\alpha=45^0$, calculate average load voltage.

RMS load voltage, average and RMS load current. Form factor and Ripple factor. **[6]**

P.T.O.

Q5) a) Explain working of three phase half controlled converter with RL load & firing angle of 60°. Draw output voltage and current waveforms. Derive expression for average output voltage and rms voltage. **[8]**

b) Write a short note on DIAC. With neat diagram explain triggering of TRIAC using DIAC. **[8]**

OR

Q6) a) Explain working of three phase full controlled converter with RL load & firing angle of 30°. Draw output voltage and current waveforms. Derive expression for average output voltage and rms voltage. **[8]**

b) Explain operation of single phase ac voltage regulator with output voltage and current waveforms for RL Load. Write expression for rms output voltage. **[8]**

Q7) a) Explain various PWM techniques used in inverters. How sinusoidal PWM is used for harmonic elimination? **[8]**

b) Explain with neat circuit diagram working of single phase full bridge voltage source inverter connected to RL load. Draw output voltage and current waveforms and comment on need of feedback diodes. **[8]**

OR

Q8) a) i) Compare Single pulse and multiple pulse modulation. **[4]**

ii) Write a short note on Current Source lnverter. **[4]**

b) Derive the expression for output voltage and current of a single phase bridge inverter. **[8]**

Q9) a) Explain cascaded multilevel inverter using 3 H-bridges connected to input supply. **[10]**
Draw output voltage waveforms. What are its advantages?

b) Explain different harmonic elimination techniques used in inverter. **[8]**

OR

Q10)a) Explain working of three phase voltage source inverter in 120^0 mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. **[10]**

b) Write short note on Flying capacitor multilevel inverter. **[8]**

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Total No. of Questions :6]

SEAT No. :

P30

[Total No. of Pages :2

Oct./TE/ Insem. - 144

T.E. (Electrical)

POWER ELECTRONICS

(2015 Course) (Semester - I)

Time : 1 Hour] *[Max. Marks :30*

Instructions to the candidates:

1) ***Attempt any one question from Q.1or Q.2, Q.3 or Q.4, Q.5 or Q.6.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Assume suitable data, if necessary.***

Q1) a) Draw neat diagram explain class C Commutation of thyristor. **[5]**

b) Explain with neat circuit diagram operation of R-C triggering circuit of Thyristor. **[5]**

OR

Q2) a) Describe the different modes of operation of SCR with the help of V - I characteristic. **[5]**

b) With construction diagram explain working of GTO. **[5]**

Q3) a) List different voltage control techniques of Chopper. Elaborate Time Ratio Control (TRC) method. **[5]**

b) Write short note on class E Chopper. **[5]**

OR

Q4) a) Draw and explain output and transfer characteristics of MOSFET. **[5]**

b) Write a short note on necessity of input filter. **[5]**

P.T.O.

Q5) a) With neat output voltage waveforms explain rectification and inversion mode of operation of single phase fully controlled converter with RL load. **[5]**

b) Describe working of single phase semi converter with RL load. Draw waveforms of load voltage, load current. **[5]**

OR

Q6) a) Describe working of single phase circulating type of dual converter with output voltage waveform. **[5]**

b) Derive expression for average output voltage and rms output voltage of a single phase fully controlled converter with RL load (Assume continuous conduction) **[5]**

Total No. of Questions : 8]

SEAT No. :

P745

[Total No. of Pages : 3

[5870]-1048
T.E. (Electrical)
POWER ELECTRONICS
(2019 Pattern) (Semester - I) (303142)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of calculator is allowed.***
5) ***Assume Suitable data if necessary.***

Q1) a) Explain working of single phase semi controlled bridge converter connected to R Load with neat circuit diagram and waveforms. **[6]**

b) Derive the equation for average and rms output voltage of single phase fully controlled converter connected to RL. Load. **[6]**

c) The semi controlled converter with RL Load is connected to a 120 V, 60 Hz supply. The load current I_L is assumed to be continuous and ripple free. If delay angle is 90 degrees, calculate average output voltage, rms voltage, DF and PF. **[6]**

OR

Q2) a) Explain working of single phase fully controlled bridge converter connected to R Load with neat circuit diagram and waveforms. **[6]**

b) Derive the equation for average and rms output voltage of single phase semi controlled converter connected to RL Load. **[6]**

c) A single phase fully controlled bridge converter is connected to R Load of 10Ω. The input voltage to the bridge is 230 V. Calculate. **[6]**

i) Average and RMS load voltage

ii) Average and RMS load voltage

Firing angle is 60 degrees.

P.T.O.

Q3) a) Explain working of single phase AC Voltage regulator with R Load. Draw output voltage waveforms. **[5]**

b) A three phase full converter operating from 3 phase 415 V, 50 Hz supply with Resistive load. Determine average output voltage for $\alpha = 30$ degrees & $\alpha = 90$ degrees. **[5]**

c) Explain working of Three phase fully controlled converter connected to R Load with neat circuit diagram and waveforms. Consider firing angle $\alpha = 60$ degrees. **[8]**

OR

Q4) a) Explain working of two stage AC Voltage regulator with RL Load. Draw output voltage waveforms. **[5]**

b) Compare Three phase Semi converter and Three phase fully controlled converters based on Number of SCRs, Quadrant of Operation, Modes of Operation, Energy feedback, Average load voltage for RL Load. **[5]**

c) Explain working of Three phase semi controlled converter connected to R Load with neat circuit diagram and waveforms. Consider firing angle $\alpha = 30$ degrees. **[8]**

Q5) a) Explain working of single phase full bridge voltage source Inverter connected to RL load with neat circuit diagram. Draw output voltage and current waveforms. **[7]**

b) What is need of controlling output voltage in an inverter? Explain any one method in detail. **[5]**

c) Compare current source inverter and voltage source Inverter. **[5]**

OR

Q6) a) Explain working of single phase full bridge voltage source inverter connected to R load with neat circuit diagram. Draw output voltage and current waveforms. **[7]**

b) Explain working of single phase current source inverter with neat circuit diagram. Draw output voltage and current waveforms. **[5]**

c) What is need of UPS? Explain working of UPS with neat circuit diagram. **[5]**

Q7) a) What are different harmonic elimination techniques in inverter? Explain any one method. **[5]**

b) What is necessity of using Multilevel Inverters? Draw circuit diagram of H bridge multilevel Inverter. **[5]**

c) Explain working of three phase inverter with 180 degree conduction mode with neat diagram and switching sequence of switches. **[7]**

OR

Q8) a) Compare multi-pulse and multilevel inverters. **[5]**

b) Draw circuit diagram of three level flying capacitor converter and explain its principal of operation. **[5]**

c) Explain working of three phase inverter with 120 degree conduction mode with neat diagram and switching sequence of switches. **[7]**

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Total No. of Questions : 8]

SEAT No. : ____

P283

[Total No. of Pages : 2

[6003]-362
T.E. (Electrical)
POWER ELECTRONICS
(2019 Pattern) (Semester-I) (Theory) (303142)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicates full marks.***
4) ***Use of calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) A single phase half controlled bridge converter feeds a load comprising of a resistance of 10 ohm and a large inductance to provide a constant and ripple free current. Calculate the average value of output voltage and current. Firing angle is 45° and input ac voltage is 120V, 50Hz. **[8]**

b) Describe working of single phase bridge converter with RL load. Draw waveforms of load voltage, load current and derive equation for average load voltage and Current. **[9]**

OR

Q2) a) Describe working of circulating current type single phase dual converter with waveforms. **[8]**

b) Draw and explain Single phase semi converter feeding R load with output voltage and current wave forms. Also derive output average and rms voltage equation. **[9]**

Q3) a) A three phase half wave controlled converter is fed from 3 phase, 400V, 50Hz source and is connected to a resistive load of 10 ohm per phase. Calculate the average value of laod voltage and current for a firing angle of 30º and 60º. **[10]**

b) What is two stage ac voltage regulator? Draw neat diagram and explain its operation with output waveform for RL load. **[8]**

OR

P.T.O.

Q4) a) Describe working of three phase fully controlled converter & Draw output voltage and current waveforms for R load when α =60º. **[10]**

b) Draw and explain three phase semi converter feeding RL load with output volatage wave forms. **[8]**

Q5) a) Explain with circuit diagram and waveforms operation of single phase current source inverter. **[8]**

b) For single pulse width modulation with quasi square wave, show that output voltage can be expressed as

$V_0 = \sum_{n=1,3,5....}^{\infty} \frac{4Vs}{n\pi} \sin\frac{n\pi}{2} \sin nd \sin nwt$. Where Vs is source voltage and pulse width is 2d. **[9]**

OR

Q6) a) State different voltage control techniques used in single phase inverter. Elaborate any two methods in detail. **[8]**

b) Explain Sinusoidal pulse width modulation with necessary waveforms. **[9]**

Q7) a) Explain working of three phase six step voltage source inverter in 180º mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. **[10]**

b) List different harmonic elimination techniques used in inverter. Explain any two methods in detail. **[8]**

OR

Q8) a) Explain working of three phase six step voltage source inverter in 120º mode of operation. For star connected load draw output voltage waveforms. Show devices conducting in each step. **[10]**

b) Draw a neat diagram and explain Flying capacitor multilevel converter. **[8]**

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Total No. of Questions : 8]

SEAT No. : [ ]

PA-1457

[Total No. of Pages : 3

[5926]-73

T.E. (Electrical)

POWER ELECTRONICS

(2019 Pattern) (Semester - I) (303142)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicates full marks.***
4) ***Use of calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) Describe working of single phase semi converter with R load. Draw waveforms of load voltage, load current for $\alpha = 60^{o}$. **[6]**

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 delay of 45º determine. **[5]**

i) Average output voltage

ii) Average output current

c) With neat circuit diagram derive the equation for average and rms output voltage of single phase fully controlled converter connected to RL Load.**[6]**

OR

Q2) a) Draw a neat circuit diagram and explain working of a single - phase fully controlled bridge converter feeding RL load with freewheeling diode.**[6]**

b) A single-phase half-controlled bridge converter feeds a load comprising of a resistance of 10 Ohm and a large inductance to provide a constant and ripple free current. Calculate average value of Output voltage and current. Firing angle is 45 degrees and input ac voltage is 120V, 50Hz.**[5]**

c) Write short note on single phase dual converter. **[6]**

P.T.O.

Q3) a) Explain operation of two stage ac voltage regulator with an output waveform for RL load. **[5]**

b) A three-phase half wave-controlled converter is fed from 3 phase, 400 V, 50 Hz source and is connected to a resistive load of 10 Ohm per phase. Calculate the average value of load voltage and current for a firing angle of 30 degrees. **[5]**

c) Explain working of three phase fully controlled converter with RL Load and firing angle of 60 degrees. Draw output voltage waveforms. **[8]**

OR

Q4) a) With the help of circuit diagram and waveforms explain operation of Light dimmer. **[5]**

b) A three phase full converter operating from 3 phase 415V, 50Hz supply with Resistive load. Determine average output voltage for $\alpha = 30$ degrees. **[5]**

c) Explain working of three phase Semi controlled converter with R Load and firing angle of 30 degrees. Draw output voltage waveforms. **[8]**

Q5) a) Explain with neat labeled circuit diagram working of single - phase full bridge voltage source inverter connected to RL load. Draw output voltage and current waveforms. **[5]**

b) Compare current source inverter and voltage source inverter. **[5]**

c) Derive expression for output voltage in single pulse modulation by fourier analysis. **[7]**

OR

Q6) a) What is need of controlling output voltage in an inverter? Explain any one method in detail. **[5]**

b) A 1φ half bridge inverter using transistors has a resistive load of 2 Ohm. The DC supply is 24 V. Calculate. **[5]**

i) RMS output voltage at fundamental frequency.

ii) Output power.

iii) Average and peak current.

iv) Peak reverse blocking voltage of each transistor.

c) Explain Sinusoidal pulse width modulation with necessary waveforms. How voltage and frequency control is achieved. **[7]**

Q7) a) Explain working of three phase inverter with 180 degree conduction mode with neat diagram, switching sequence of switches and output voltage waveforms. **[10]**

b) Draw circuit diagram of three level flying capacitor converter and explain its principal of operation. **[8]**

OR

Q8) a) Explain working of three phase inverter with 120 degree conduction mode with neat diagram, Switching sequence of Switches and output voltage waveforms. **[10]**

b) Draw circuit diagram of three level flying capacitor converter and explain its principal of operation. **[8]**

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Total No. of Questions : 4]

SEAT No. : ____

P8563

[Total No. of Pages : 2

Oct-22/TE/Insem-534

T.E. (Electrical)

POWER ELECTRONICS

(2019 Pattern) (Semester - I) (303142)

Time : 1 Hour] ***[Max. Marks : 30***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) State and explain different modes of operation of SCR with the help of V-I characteristics. **[5]**

b) Explain the triggering of SCR using RC gate triggering. **[5]**

c) Explain the following specifications of Thyristor - **[5]**

i) dv/dt

ii) di/dt

iii) VGT

iv) VRRM

v) IT (RMS)

OR

Q2) a) With neat constructional diagram explain working of GTO. Draw its V- I Characteristic. **[5]**

b) What is commutation? Explain class C commutation of SCR. **[5]**

c) With neat circuit diagram explain how overcurrent protection provided to Thyristor. **[5]**

P.T.O.

Q3) a) Explain first quadrant chopper. How these choppers can be used to obtain two quadrant choppers? **[5]**

b) Draw and explain output and transfer characteristics of MOSFET. **[5]**

c) What is the duty cycle of chopper and explain PWM and FM techniques of voltage control. **[5]**

OR

Q4) a) Explain class 'B' chopper with neat circuit diagram. Draw output voltage & output current waveforms. **[5]**

b) Describe the principle of step up chopper. Derive an expression for average output voltage in terms of input voltage and duty cycle. **[5]**

c) A step up chopper has input voltage of 220 V and output voltage of 660V. If the conducting time of chopper is 100µsec, calculate the pulse width of output voltage. **[5]**

Total No. of Questions : 4]

SEAT No. :

P5034

[Total No. of Pages : 2

[6187]-434
T.E. (Electrical Engineering) (Insem)
POWER ELECTRONICS
(2019 Pattern) (Semester - I) (303142)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable additional data if, necessary.***
5) ***Use of non-programmable calculator is allowed.***

Q1) a) Draw and explain constructional details of SCR and GTO, specify constructional difference between them. **[7]**

b) What is commutation of SCR? Explain class 'C' and 'D' commutation with the help of necessary circuit and waveforms. **[8]**

OR

Q2) a) With the help of constructional diagram, explain construction and working of TRIAC. **[7]**

b) Draw the dynamic characteristics of SCR and define all related time spans for switching ON. **[8]**

Q3) a) Explain the working of calss 'D' chopper with appropriate waveforms to demonstrate its operation in first and fourth quadrants. Indicate the range of duty cycle for which it operates in first and fourth quadrants.**[7]**

b) What is "Duty Cycle Control" of a chopper? How PWM and FM control is used? Compare. **[8]**

OR

P.T.O.

Q4) a) A step-up chopper has an input voltage of 150V. The voltage output needed is 450V. Given that the thyristor has a conducting time of 150μseconds. Calculate the chopping frequency. If T_{ON} is halved, keeping chopping frequency constant, what will be output voltage. **[7]**

b) Draw output and transfer characteristics of MOSFEFT and explain the terms: **[8]**

i) Pinch off voltage

ii) Threshold voltage

iii) Trans conductance

iv) Turn on & turn off characteristics

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