Code No: RT31025 **R13** SET - 1

III B. Tech I Semester Regular Examinations, November - 2015
POWER ELECTRONICS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1	a)	Define Latching and Holding currents.	[4M]
	b)	Discuss briefly about advantages of freewheeling diode.	[4M]
	c)	Discuss about line commutated inverter.	[4M]
	d)	Draw the variation of output voltage with respect to firing angle of three phase semi converter.	[4M]
	e)	Explain time ratio control of DC-DC chopper	[3M]
	f)	What are the applications of Inverters?	[3M]

PART -B

2	a)	Explain about snubber circuit and derive the condition for R_s?	[8M]
	b)	What is a MOSFET? Explain its V-I characteristics briefly. Also write its advantages over other switches.	[8M]
3	a)	Explain the operation of single phase half wave converter with RL load. Draw the output voltage waveform and derive the expression for average load voltage.	[8M]
	b)	A single phase full-wave ac voltage controller feeds a load of R=20 Ω with an input voltage of 230V, 50Hz. Firing angle for both the thyristors is 45^0. Calculate (i) rms value of output voltage. (iii) Average and rms current of thyristors.	[8M]
4	a)	Derive the expression for output voltage of single-phase full converter by considering source inductance.	[8M]
	b)	Single phase fully controlled converter is connected to a load comprised of 2ohms resistance and 0.3H inductance. The supply voltage is 230V at 50Hz. Estimate the average load voltage, average load current and input power factor for a firing angle of 20^0. Assume continuous and ripple free load current.	[8M]
5		Describe the working of three phase half controlled converter with R load for $\alpha=30^o$ with relevant waveforms and derive the expression for average output voltage.	[16M]

6 a) Discuss the working of a single phase bridge type cycloconverter with RL loads and for discontinuous waveform operation with neat circuit diagram and output rms voltage and current wave form for $f_o = (1/3)\ f_s$. [8M]

b) Explain the operation of Buck-Boost chopper with relevant waveforms and derive the expression for average output voltage. [8M]

7 a) With a neat circuit diagram, explain the principle of operation of a single phase half bridge inverter. [6M]

b) A single PWM full bridge inverter feeds an RL load with R = 10 ohms and L =10 mH. If the source voltage is 120V, find out the total harmonic distortion in the output voltage and in load current. The width of each pulse is 120^0 and output frequency is 50Hz. [10M]

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PART –A

1	a)	Draw and explain the transfer characteristics of MOSFET.	[4M]
	b)	Define firing angel.	[3M]
	c)	What is commutation angle or overlap angle?	[3M]
	d)	Draw the output voltage waveform of three phase full converter with RL load and firing angle 90^0.	[4M]
	e)	What are the applications of Cyclo converters?	[4M]
	f)	What are the advantages of PWM techniques?	[4M]

PART -B

2	a)	Discuss about switching characteristics of an SCR during turn on and off.	[8M]
	b)	Explain the diode bridge rectifier with R load and capacitive filter with neat circuit diagram and necessary waveforms.	[8M]
3	a)	Explain RC firing circuit with suitable waveforms.	[8M]
	b)	A 230V, 50Hz, one-pulse SCR controlled converter is triggered at a firing angle of 40^0 and the load current extinguishes at an angle of 210^0. Find the average output voltage and the average load current for R=5 Ω and L=2mH.	[8M]
4	a)	Describe the working of single phase half controlled converter for $\alpha = 30^o$ with relevant waveforms and derive expression for average output voltage.	[8M]
	b)	A 1-Φ full converter bridge is connected to RLE load. The source voltage is 230V, 50Hz. The average load current of 10A is constant over the working range. For R=0.4Ω and L=2mH, compute. i) Firing angle delay for E=120V and ii) Firing angle delay for E= -120V. Indicate which source is delivered power to load in above cases.	[8M]
5	a)	Briefly explain the operation of single-phase dual converter.	[6M]
	b)	A 3-Φ fully controlled bridge converter is supplying DC-load of 400V, 60A from a 3-Φ, 50Hz, 660V (line) supply. If the thyristors have a voltage drop of 1.2V when conducting, then neglecting overlap, compute. a) Firing angle of thyristor. b) RMS value of thyristor currents. c) Mean power loss in thyristors .	[10M]

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6 a) Discuss the working of a single phase bridge type cycloconverter with RL loads and for continuous waveform operation with neat circuit diagram and output rms voltage and current wave form for $f_o = (1/4)\ f_s$. [9M]

b) Explain the operation of Boost chopper with relevant waveforms and derive the expression for average output voltage. [7M]

7 Explain the operation of three-phase bridge inverter for 180^o mode of operation with aid of relevant phase and line voltage waveforms. [16M]

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Code No: RT31025 **R13** SET - 3

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2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1 a) Draw and explain the output characteristics of IGBT. [4M]

b) Draw the output voltage waveform of single phase AC voltage controller with RL load. [4M]

c) Define extinction angle. [3M]

d) What are the applications of dual converter. [3M]

e) Explain current limit control of DC-DC chopper. [4M]

f) Define amplitude modulation index. [4M]

PART -B

2 a) Explain various turn-on methods of an SCR. [8M]

b) A thyristor operating from a peak supply voltage of 400V has the following specifications: Repetitive peak current, I_p = 200A, $(di/dt)_{max}$ = 50A/μs, $(dv/dt)_{max}$ = 200V/μs. Choosing a factor of safety 2 for I_p, $(di/dt)_{max}$ and $(dv/dt)_{max}$, design a suitable snubber circuit. The minimum value of load resistance is 10Ω? [8M]

3 a) What is UJT firing circuit and explain it with suitable waveforms? [8M]

b) A single phase half controlled bridge converter is supplied a 230V, 50Hz. Determine the average load voltage for firing angle of 60^0. If load current of 30A is continuous and constant, what is the value of load resistance? [8M]

4 a) Describe the working of single-phase fully controlled bridge converter in the Rectifying mode and inversion mode. And derive the expressions for average output voltage and rms output voltage. [8M]

b) Single phase fully controlled bridge is used for obtaining a regulated converter dc output voltage. The rms value of ac input voltage is 220V and firing angle is maintained at 30^0, so that the load current is 4A.
(a) Calculate the d.c. output voltage and active and reactive power input.
(b) Assuming load resistance remains same and if free-wheeling diode is used at the output, calculate dc output voltage. The firing angle is maintained at 30^0. [8M]

5 Explain the operation of three phase fully controlled bridge converter with RL load. Draw the voltage and current waveforms for $\alpha = 45^0$. List the firing sequence of SCRs. [16M]

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6 a) What are cycloconverters? Discuss the working of a single phase bridge type cycloconverter with R load. Sketch a neat circuit diagram and output rms voltage and current wave form for $f_o = (1/3)\ f_s$. [9M]

b) Explain the operation of Buck chopper with relevant waveforms and derive the expression for average output voltage. [7M]

7 What are different applications of inverters? Explain the operation of 3ph bridge inverter for 120^o mode of operation with aid of relevant phase and line voltage waveforms. [16M]

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2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1	a)	Define turn off time of an SCR.	[3M]
	b)	Explain the principle of line commutation.	[4M]
	c)	Discuss the significance of source inductance.	[4M]
	d)	Explain circulating and non-circulating current operation in dual converters.	[4M]
	e)	What is a cyclo converter?	[3M]
	f)	Explain briefly sine triangular PWM technique.	[4M]

PART -B

2	a)	Explain the static V-I characteristics of a thyristors and different modes of operation.	[8M]
	b)	Explain the diode bridge rectifier with R load and the output voltage waveform.	[8M]
3	a)	Explain the operation of single phase AC voltage controller with R load. Draw the necessary waveforms.	[8M]
	b)	A 230V, 1kW electric heater is fed through a single phase AC voltage controller from 230V, 50Hz Source. Find the load power for a firing angle delay of 70^0. Derive the expression used.	[8M]
4	a)	Derive the expressions for the following performance factors of single-phase fully Controlled bridge converter. (i)Input power factor (ii) Voltage ripple factor (iii) Active power input (iv) Reactive power input	[8M]
	b)	The 1- Φ semi converter circuit is connected to a 120V, 60 Hz supply. Determine the harmonic factor, distortion factor and input power factor if delay angle is $\alpha = \pi/2$.	[8M]
5		Explain the operation of three phase fully controlled bridge converter with RLE load. Draw the voltage and current waveforms for $\alpha = 60^0$. List the firing sequence of SCRs.	[16M]
6	a)	For a single phase bridge type cyclo-converter, explain the operation of the circuit when fed to R-load with the help of neat circuit diagram and relevant output waveforms for $\alpha = 30^0$ and $\alpha = 120^0$ for $f_0 = 1/4\ f_s$.	[10M]
	b)	Discuss the methods of controlling the output voltage of a chopper.	[6M]

7 a) With a neat circuit diagram, explain the principle of operation of a single phase full bridge inverter. [6M]

b) A single phase full bridge inverter uses a uniform PWM with two pulses per half cycle for voltage control. Plot the distortion factor, fundamental component, and lower order harmonics against modulation. [10M]

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