Code No: R1631025 **R16** SET - 1

III B. Tech I Semester Regular Examinations, October/November - 2018

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. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1.	a)	Draw the turn – OFF characteristics of SCR.	[2M]
	b)	Explain the effect of source inductance in fully controlled bridge rectifier with continuous conduction.	[2M]
	c)	Draw the circuit diagram of a 3-phase full wave uncontrolled rectifier.	[2M]
	d)	Explain duty cycle in step up chopper operation	[3M]
	e)	What is the principle of operation of Inverter?	[3M]
	f)	Compare turn off mechanism of TRIAC and Thyristor	[2M]

PART –B

2.	a)	What is power MOSFET? What are the types of power MOSFET? Write the difference between general purpose MOSFET and power MOSFET?	[7M]
	b)	Describe the basic behavior of thyristor using a two- transistor model.	[7M]
3.		What is phase angle controlled technique? Explain the operation of single – phase angle controlled rectifier. Derive the expression for average dc output voltage. Draw the relevant waveforms.	[14M]
4.		A three –phase full converter is connected to a load resistance of 5 Ω and it is supplied from a 220 V, 50 Hz ac supply, If the firing angle of thyristor is $\alpha = 30^o$, Draw the relevant waveforms and determine i) average output voltage, ii) average output current, iii) rms output voltage and iv) rms output current.	[14M]
5.	a)	Explain the operating principle of dc chopper with a suitable diagram. Draw the voltage and current waveforms of chopper. Derive expressions for average output voltage and rms output voltage.	[10M]
	b)	Discuss the principle of operation of Buck-Boost converter.	[4M]
6.	a)	Describe the V-I characteristics of TRIAC and modes of operation.	[7M]
	b)	A single –phase half –wave ac voltage controller is connected with a load of $R = 5\ \Omega$ with an input voltage of 230 V, 50 Hz. If the firing angle of thyristor is 45^o , determine i) RMS output voltage, ii) Power delivered to load	[7M]
7.	a)	What are pulse width modulated inverters? What are the different PWM techniques used in inverter?	[7M]
	b)	With the help of a neat circuit diagram and waveforms, explain the operation of 3-phase bridge inverter with R load.	[7M]

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Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Explain the turn – ON and turn – OFF time of SCR. [2M]
   b) Draw the 1-phase fully controlled rectifier circuit with freewheeling diode. [2M]
   c) In the case of a 3-phase , half controlled rectifier feeding a purely resistive load, if two values of the firing angle α are measured from the point of natural commutation are 20 and 40 degrees , then obtain the extinction angles measured from the origin. [2M]
   d) Draw the static V-I characteristics of TRIAC. [3M]
   e) List the advantages and disadvantages of Boost converter. [3M]
   f) Compare VSI and CSI. [2M]

PART –B

2. a) Draw the V-I characteristics of a power MOSFET and explain different operating regions. [7M]
   b) Draw the V-I characteristics of SCR and explain it briefly? [7M]
3. a) A single phase 220 V, 1 kW heater is connected to a half- wave controlled rectifier and fed from a 220 V, 50 Hz ac supply, Determine the power absorbed by the heater when the firing angle is i) $\alpha = 30^o$ and ii) $\alpha = 90^o$. [10M]
   b) Write the advantage of freewheeling diode in single–phase half –wave controlled rectifier with *RL* load. [4M]
4. Draw the circuit diagram of three – phase, half –wave controlled rectifier with *R* load and explain its operating principle with voltage and current waveforms. Determine the following parameters for *R* load with firing angle $\alpha = 60^o$: i) dc output voltage ii) Average dc load current iii) rms output voltage iv) rms load current. [14M]
5. a) Explain the different control strategies in DC-DC circuits? [7M]
   b) Discuss the Principle of operation of forward and fly back converters in CCM. [7M]
6. a) Describe working of 3-Phase AC-AC regulators with R load only and draw the relevant waveforms. [7M]
   b) A single phase full –wave ac voltage controller is connected with a load of $R = 10\ \Omega$, with an input voltage of 230 V, 50 Hz. When the firing angle of thyristors is 45^o, determine i) power output at load, ii) average value of thyristor current and iii) rms value of thyristor current. [7M]
7. a) What is pulse width modulation? List the various PWM techniques. How do these differ from each other? [7M]
   b) A single-phase PWM inverter is fed from a 220 V dc supply and it is connected to a RL load with R=10 ohms and L=10 mH. Determine the total harmonic distortion in the load current .Assume width of each pulse is π/2 and the output frequency is 50 Hz. [7M]

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Code No: R1631025 **R16** SET - 3

III B. Tech I Semester Regular Examinations, October/November - 2018

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. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Compare Power MOSFET and IGBT. [2M]
   b) What would be the input power factor in a 1-phase rectifier if extinction angle control is used for improving power factor with angle β is 50° [2M]
   c) A 3-phase controlled rectifier feeds a purely resistive load. The data are Vs= 220V (rms) and R_{ld} = 15 ohms. If the firing angle α is 45^{o} then what would be the duration of conduction of thyristor. [2M]
   d) Discuss the time ratio control in a dc chopper [3M]
   e) Draw the waveforms for 1-phase fully controlled ac regulator with inductive load. [3M]
   f) Why a PWM inverter is superior to a square wave Inverter? [2M]

PART –B

2. a) Draw the switching characteristics of power MOSFETs. Define turn- ON delay time, rise time, turn – ON time, turn- OFF delay time, fall time and turn- OFF time. [7M]
   b) What are the different turning – ON methods of a thyristor? Explain each method. [7M]

3. a) Draw the circuit diagram of a single – phase full wave controlled rectifier using centre tap transformer with R load and find dc output voltage. [7M]
   b) A single phase fully controlled bridge converter with RL load is supplied from 220 V, 50 Hz ac supply. If the firing angle is 45^{o}, determine i) average output voltage, ii) output current iii) input power factor. [7M]

4. a) Draw the circuit diagram of a three phase bridge converter with *RL* load. Discuss its working principle. Draw the voltage and current waveforms. Determine the following parameters: [14M]
   i) dc output voltage ii) average dc load current iii) rms output voltage
   iv) rms load current .

5. With the help of a neat circuit diagram and associated waveforms, discuss the operation of Buck-Boost converter. [14M]

6. a) Draw the single – phase bidirectional ac voltage controller with *R* load and explain its working principle with waveforms. [7M]
   b) Draw the waveforms for 3-phase a.c voltage regulator for R load for firing angle 60^{o} [7M]

7. Explain the working of TRIAC as voltage controller with R load and draw the relevant waveforms. [14M]

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Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1.	a)	What is Sunbber circuit?	[2M]
	b)	In a 1-phase bridge type of controlled rectifier supplying RL load, under what conditions discontinuous conduction occurs.	[2M]
	c)	Draw a 3-phase half wave controlled converter circuit diagram and output voltage wave form for R load.	[2M]
	d)	List the advantages and disadvantages of Buck-Boost converter	[3M]
	e)	How shoot through fault will be prevented in VSI.	[3M]
	f)	What is meant by integrated cycle control	[2M]

PART –B

2.	a)	What is IGBT? What are the advantages of IGBT over power BJT and power MOSFET?	[7M]
	b)	Draw the V-I characteristics of a thyristor and explain different operating regions. What is the effect of Gate current on the V-I characteristics of a thyristor?	[7M]
3.	a)	What is the effect of source inductance in single –phase full – wave controlled bridge rectifier with *RL* load? (b) Draw the voltage and current waveforms	[10 M]
	b)	Explain how a free – wheeling diode improves power factor in a converter.	[4M]
4.		Draw the circuit diagram of 3 – phase half –wave controlled rectifier with *RL* load and explain its operating principle with voltage and current waveforms. Determine the following parameters for *RL* load with firing angle $\alpha = 30^o$: i) dc output voltage ii) Average dc load current iii) rms output voltage iv) rms load current v) Ripple factor	[14M]
5.		With help of neat circuit diagram and associated waveforms discuss the operation of a Buck converter in continuous conduction mode and discontinuous conduction mode.	[14M]
6.		Derive the expression for rms output voltage of bidirectional 1-phase ac voltage controller with RL load. And draw the relevant waveforms.	[14M]
7.		Explain the working of a 1-phase full bridge Inverter with RL load. Draw the relevant output waveforms.	[14M]

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