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Note : Remove "Table of Content" before including in CP Book

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Each Course Plan shall be printed and made into a book with cover page

Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

15EC73. POWER ELECTRONICS

A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	EC
Year / Semester :	4/7	Academic Year:	2019-20
Course Title:	Power Electronics	Course Code:	15EC73
Credit / L-T-P:	4-0-0	SEE Duration:	180 Minutes
Total Contac	t 50	SEE Marks:	80 Marks
Hours:			
CIA Marks:	20	Assignment	1 / Module
Course Plan Author	: Vanitha K S	Sign	Dt:
Checked By:		Sign	Dt:

2. Course Content

Mod	Module Content	Teaching	Module	Blooms
ule		Hours	Concepts	Level
1	Introduction – Applications of Power Electronics, Power	10	Basics of	L3,L4
	Semiconductor Devices, Control Characteristics of Power		Power	
	Devices, types of Power Electronic Circuits. Power		Converters	
	Transistors: Power BJTs: Steady state characteristics. Power			
	MOSFETs: device operation, switching characteristics, IGBTs:			
	device operation, output and transfer characteristics.			
			Diode	
			Rectification	
2	Thyristors – Introduction, Principle of Operation of SCR,	10	Switching	L3, I4
	Static AnodeCathode Characteristics of SCR, Two transistor		Operation	
	model of SCR, Gate Characteristics of SCR, Turn-ON			
	Methods, Turn-OFF Mechanism, Turn-OFF Methods: Natural			
	and Forced Commutation - Class A and Class B types,Gate		Driver circuit	
	Trigger Circuit: Resistance Firing Circuit, Resistance			
	capacitance firingcircuit.			
3	Controlled Rectifiers – Introduction, principle of phase	10	Switching	L3,14
	controlled converter operation, Single phase full converters,		Operation	
	Single phase dual converters. AC Voltage Controllers –			
	Introduction, Principles of ON–OFF Control, Principle of		Firing Circuit	
	Phase Control, Single phase control with resistive and			

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	inductive loads.		
4	DC-DC Converters – Introduction, principle of step-down operation and it's analysis with RL load, principle of step-up operation, Step-up converter with a resistive load, Performance parameters, Converter classification, Switching	Rectification using controlled rectifier	L3,I4
	mode regulators: Buck regulator, Boost regulator, Buck– Boost Regulators.	Performance parameters	
5	Pulse Width Modulated Inverters- Introduction, principle of operation,performance parameters, Single phase bridge inverters, voltage control of single phase inverters, current source inverters, Variable DC-link inverter, Boost inverter.	Principle	L4, L4
	Static Switches: Introduction, Single phase AC switches, DC Switches, Solid state relays, Microelectronic relays.	Performance parameters	

3. Course Material

Mod	Details	Available
ule		
1	Text books	
1.	Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications,	In LLB
	3rd/4th Edition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844- 5.	
2.	M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc- GrawHill, 2009, ISBN: 0070583897	
2	Reference books	
	L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.	In LIB
2.	Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi, 2012.	
3	P.C. Sen, "Modern Power Electronics", S Chand &Co New Delhi, 2005.	

4. Course Prerequisites

SNo	Course	Course Name	Module / Topic /	Description	Sem	Remarks	Blooms
	Code						Level
1	15ELN1	Basic Electronics	1. Knowledge on Bas	sic working	1	-	L2
	5						
	-	-			-		
2	15EC32	Analog	FET, MOSFET	Construction,	3	-	L3
		Electronic	working, Characteris	stics			
		Circuits					
						Plan Gap Course	

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Note: If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

B. OBE PARAMETERS

1. Course Outcomes

-	Total	61	-	-	-	-
			parameters			
0	and three phase DC-AC converters		e		t	Analyze
_	Design and analyse the single phase	05	Performanc	Lecture	Assignmen	L4
	chopper by varying the duty cycle.					
	operation of step up and step down					Analyze
15EC73.9	Understand the principle of		Principle			L4
			parameters			
	controller		e		t	Analyze
15EC73.8	Design and analyse the AC voltage	06	Performanc	Lecture	Assignmen	L4
	rectifier by producing firing pulses.		rectifier			
	phase and three phase controlled		controlled		Test	
	operation and designing of single		n using		t and Unit	Apply
15EC73.7	Understand the principle of	05	Rectificatio	Lecture	Assignmen	L3
	pulses and to trigger the thyristor.			Tutorial		
	requirement to produce firing		Circuit	and	t	Analyze
15EC73.6		06	Firing	Lecture	Assignmen	L4
	characteristics and their limitations.		OperationI			Apply
15EC73.5	Describe the types of thyristors,	05	Switching	Lecture	unit test	L3
	devices.					, mury20
1 JLC/ 3.4	for turn-on and turn-off of power		circuit	PPT	t	L4 Analyze
155072 /	Design of gate and base drive circuit	04	Driver	Locturo /	Assignmen	L4
	switching characteristics and their limitation of power transistors.		Operation		t and unit Test	Applying
13EC/3.3	Understand the types, steady state,		Switching	Lecture	Assignmen	L3 Applying
1	diode on RL circuit.	07	Courie als in a	1	A	
	operation and the effect of power		n			
	characteristics, types and their		Rectificatio	PPT	t	Analyze
15EC73.2	Analyse the power diodes	07	Diode	Lecture/	Assignmen	L4
	electronic converters.					
	applications used in power		Converters			
	fundamental concept and		Power			Apply
15EC73.1	Acquire the knowledge about	05	Basics of	Lecture	Unit Test	L3
		Hours	concept	Method	t Method	Level
#	COs	Teach.	Concept	Instr	Assessmen	Blooms'

Note: Identify a max of 2 Concepts per Module. Write 1 CO per concept.



2. Course Applications

SNo	Application Area	CO	Level
1	Power diodes are used as isolating signals from supply.	CO2	L4
2	Power diodes can used as voltage reference, mixing and detection of signals	CO2	L4
3	Diode rectifiers can be used in controlling the size of the signal, used in lazer diodes.	CO2	L4
4	Transistors are used in audio amplifiers, sound reproduction, radio transmission	CO3	L3
5	BJT's are used in analog switches	CO3	L3
6	Transistors are used in low power logic gates, DC motor drives, AC motor drives	CO4	L4
7	Transistors are used in isolation circuit such as optocouplers and pulse transformers.	CO4	L4
8	Thyristors are used in Industrial application such as induction heating, dielectric heating and lamp dimming.	CO6	L4
9	Thyristors are used iin static AC /DC circuit breakers, tap changers	CO6	L4
10	TRIAC's are used in AC switches, starter circuit for lamps.	CO5	L3
11	Control rectifiers are used in speed control of DC motor, Universal motors, lamp dimming.	C07	L3
12	AC voltage controllers are used in power generation, power transmission, electric heating, induction heating, cyclo converters, matrix converters, Electric welding.	CO8	L4
13	Choppers are used in railway traction, battery charges, switched capacitance filters, variable frequency drives, class D electronic amplifiers, battery operated electric cars.	CO9	L4
14	Inverters are used in HVDC power transmission at the receiving end, Uninterrupted power supply, Air conditioning, refrigeration, synchronverters, electroshock weapons	CO10	L4

Note: Write 1 or 2 applications per CO.

3. Articulation Matrix

(CO – PO MAPPING)

-	Course Outcomes				Р	rogr	am (Dutc	ome	S				
#	COs	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	Level
		1	2	3	4	5	6	7	8	9	10	11	12	
15EC53.1	Acquire the knowledge about	3								3				L3
	fundamental concept and													
	applications used in power													
	electronic converters.													
15EC53.2	Analyze the power diodes	3	3							3				L4
	characteristics, types and their													

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	-	nd the effect of on RL circuit.											
15EC53.3	state, switch	the types, steady ning characteristics mitation of power	3	3					3		L3		
15EC53.4		ate and base drive rn-on and turn-off vices.		3					3		L4		
15EC53.5		the types of characteristics and ons.	3	2					3		L3		
15EC53.6	· ·	ne gate control to produce firing to trigger the	3	3	2				3		L4		
15EC53.7	operation a	the principle of and designing of e and three phase rectifier by ring pulses.		3	2				3		L3		
15EC53.8	Design and voltage cont	analyse the AC roller	3	3							L4		
15EC53.9	operation of	the principle of f step up and step per by varying the		3					3		L4		
15EC53.10	phase and t converters	analyse the single hree phase DC-AC	3						3		L4		
	Average												

4. Mapping Justification

Мар	ping	Justification				
			Level			
СО	PO	-	-			
CO1	PO1	Basics of semiconductor & converter circuits	L1			
CO1	PO9	MOSFET, IGBT Lab experiment can be included in Assesment	L3			
CO2	PO1	Basics of Switches				
CO2	PO2	Principle of SCR, MOSFET,IGBT				
CO2	PO9	Lab experiment cn be included in Assesment				
CO3	PO1	Basics of Transistors				

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CO3	PO2	Operation of SCR
CO3	PO9	SCR Lab experiment can be included in Assesment
CO4	PO1	Basics of R,L & C
CO4	PO2	Principle of gate voltage & gate current
CO4	PO9	Latching current & holding Currents Lab experiment can be included in Assesment
CO5	PO1	Basics of Rectifiers
CO5	PO2	Types of converters
CO5	PO9	TRIAC, DIAC Lab experiment can be included in Assesment
CO6	PO1	Basics of AC voltage converter
CO6	PO2	AC voltages with R, L loads
CO6	PO3	Design Ac controllers with R ,RL loads
CO6	PO9	Chopper Lab experiment can be included in Assesment
C07	PO1	Basics of DC-DC converter
CO7	PO2	Identify parameters of Choppers
C07	PO3	Analyze parameters by R, RL loads
C07	PO9	Ac voltage controlled Rectifier Lab experiment can be included in Assesment
CO8	PO1	Basics of transformer
CO8	PO2	Types of Choppers
CO9	PO1	Basics of modulator& Inverter
CO9	PO2	Compare phase, source & Current inverters
CO9	PO9	Commutation, Lab experiment can be included in Assesment
2010	PO1	Basics of Static switches
2010	PO9	Inverter Lab experiment can be included in Assesment

Note: Write justification for each CO-PO mapping.

5. Curricular Gap and Content

SNo	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					
3					
4					
5					

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Note: Write Gap topics from A.4 and add others also.

6. Content Beyond Syllabus

SNo	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
	Anything not covered a				

Note: Anything not covered above is included here.

C. COURSE ASSESSMENT

1. Course Coverage

Mod	Title	Teaching		No. of	quest	tion in	Exam		CO	Levels
ule		Hours	CIA-	CIA-	CIA-	Asg	Extra	SEE		
#			1	2	3		Asg			
1	Introduction	12	2	-	-	1	1	2	CO1,	L3, L4
	Power Diodes								CO2	
2	Power Transistors	11	2	-	-	1	1	2	CO3,	L3, L4
									CO4	
3	Thyristors	11	-	2	-	1	1	2	CO5,	L3, L4
									CO6	
4	Controlled Rectifiers	11	-	2	-	1	1	2	C07,	L3, L4
	AC voltage controller								C08	
5	DC-DC Converters	11	-	-	4	1	1	2	CO9,	L4, L4
	DC-AC Converter								CO10	
-	Total	61	4	4	4	5	5	10	-	-

Note: Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

2. Continuous Internal Assessment (CIA)

Evaluation weightage in Marks CO Levels

Other Activities – define		CO1 to Co9	L2, L3, L4
Assignment – 3	05	CO9, CO10	L4, L4
Assignment – 2	05	CO5, CO6, CO7, CO8	L3, L4, L3, L4
Assignment – 1	05	CO1, CO2, CO3, CO4	L3, L4, L3, L4
CIA Exam - 3	30	CO9, CO10	L4, L4
CIA Exam - 2	30	CO5, CO6, CO7, C08	L3, L4, L3, L4
CIA Exam - 1	30	CO1, CO2, CO3, CO4	L3, L4, L3, L4
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Note : Blooms Level in last column shall match with A.2 above.

D1. TEACHING PLAN – 1

Module – 1

Title:	Divide and Conquer	Appr	16 Hrs
		Time:	
а	Course Outcomes	-	Blooms
-	The student should be able to:	_	Level
1	Acquire the knowledge about fundamental concept and applications used in power electronic converters.	CO1	L3
2	Analyze the power diodes characteristics, types and their operation and the effect of power diode on RL circuit.	CO2	L4
b	Course Schedule	_	-
Class No	Module Content Covered	CO	Level
1	Introduction: Applications of Power Electronics,	C01	L3
2	Types of Power Electronic Circuits,	C01	L2
3	Peripheral Effects	C01	L3
4	Characteristics and Specifications of Switch.	C01	L3
5	Power Diodes: Introduction, Diode Characteristics	C02	L3
6	Reverse Recovery Characteristics, Power Diode Types, Silicon Carbide Diodes	C02	L3
7	Silicon Carbide Schottky Diodes, Diode Switched RL Load	C02	L4
8	Freewheeling Diodes with Switched RL Load.	C02	L4
9	Diode Rectifiers: Introduction	C02	L3
10	Single-Phase Full-Wave Rectifiers	C02	L4
11	Single-Phase Full-Wave Rectifier with RL Load,	C02	L4

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12	Single-Phase Full-Wave Rectifier with a Highly Inductive Load	C02	L4
С	Application Areas	СО	Level
1	Power diodes are used as isolating signals from supply.	C02	L4
2	Power diodes can used as voltage reference, mixing and detection of		L4
	signals		
	Diode rectifiers can be used in controlling the size of the signal, used	CO2	L4
	in lazer diodes.		
d	Review Questions	-	-
1	What are the advantages of static power converters?	CO1	L3
2	What are the peripheral effects of power electronics system?	CO2	L4
3	Explain the 2 modes of operation of freewheeling diode.	CO2	L4
4	Mention and explain the different types of power electronics converter	CO1	L3
	system and also specify the form of input &output with waveform.		
5	What is a switch. What are the characteristics of an ideal switch.	CO2	L4
6	Explain the diode characteristics with different regions of operation.	CO2	L4
7	What are the difference between pn junction diode &schottky diode.	CO2	L4
	With the help of neat diagram explain the reverse recovery		
	characteristics of a diode.		
8	With the help of circuit diagram, explain the working of diode with RC	CO2	L4
	and RL load.		
9	A diode circuit is shown in figure with R=44 Ω and C=0.1 μ F. The		L4
	capacitor has an initial voltage, $Vco=Vc(t=0)=220V$. If switch S1 is		
	closed at $t=0$, determine (a) the peak diode current (b) the energy		
	dissipated in the resistor R and (c) the capacitor voltage at $t=2\mu s$.		
11	Give the symbol and characteristic features of the following devices (I)	CO1	L4
	SCR (II) IGBT (iii) TRIAC (iv) SIT		
	Experiences		
e	Experiences	 CO1	 L2
2		COT	LZ
3			
4		CO3	L3
5		205	LJ
ر			

Module – 2

Title:	Divide and Conquer	Appr	10 Hrs
		Time:	
а	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Understand the types, steady state, switching characteristics and their	CO3	L3
	limitation of power transistors.		

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oyright ©20 2	D17. CAAS. All rights reserved. Design of gate and base drive circuit for turn-on and turn-off of power devices.	CO4	L4		
b	Course Schedule	_	_		
Class No	Module Content Covered	CO	Leve		
13	Power Transistors: Introduction	CO3	L3		
14	Power MOSFETs - Steady State Characteristics, Switching Characteristics Bipolar Junction	CO3	L3		
15	Transistors – Steady State Characteristics	CO3	L3		
16	Switching Characteristics	CO3	L3		
17	Switching Limits, IGBTs, MOSFET	CO3	L3		
18	Problems	CO3	L3		
19	Gate Drive	CO4	L4		
20	BJT Base Drive	CO4	L4		
21	Isolation of Gate and Base Drives,	CO4	L4		
22	Pulse transformers and Opto-couplers.	CO4	L4		
23	Problems	CO4	L3		
С	Application Areas	CO	Leve		
1	Transistors are used in audio amplifiers, sound reproduction, radio	CO3	L3		
2	transmission BJT's are used in analog switches	CO3	L3		
3	Transistors are used in low power logic gates, DC motor drives, AC motor drives	CO4	L4		
4	Transistors are used in isolation circuit such as optocouplers and pulse transformers.	CO4	L4		
d	Review Questions	-	-		
12	Explain how anti saturation base control improves the switching performance of a BJT.	CO3	L3		
13	With the help of switching waveforms explain the switching times of a power MOSFET.	CO4	L4		
14	Give the construction, static characteristic, and applications of IGBT.	CO3	L2		
15	Write the circuit diagrams and discuss the methods of providing isolation of gate / base circuits from power circuits.	CO4	L4		
16	Give the applications of BJT?	CO4	L4		
	Differentiate between MOSFET and IGBT.	CO3	L5		
17		CO3	L2		
17 18	Why are IGBT becoming popular in their application to controlled converters?	005			
		CO3	L3		

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Explain the dri	ver circuit and protection circuits for MOSFET.	CO4	L4
For the switchi	ng circuit shown below, calculate forced $\boldsymbol{\beta}$ of the	CO3	L3
	Doc Code: Title: 7. cAAS. All rights reser Explain the dri	Doc Code: SKIT.Ph5b1.F02	Doc Code: SKIT.Ph5b1.F02 Date: 3- Title: Course Plan Page: 12 7. cAAS. All rights reserved. Explain the driver circuit and protection circuits for MOSFET. CO4

22	For the switching circuit shown below, calculate forced β of the transistor. Also calculate the ODF if the manufacturer specified β is 10. Calculate the power loss PT of the transistor.	CO3	L3
	VCC = 100 V ; VB = 5 V ; RB =0.8 Ω ; RC =12 Ω ; VCE (Sat) = 1.0 V ; VBE (Sat) = 1.0 V		
23	What is the need for isolation of gate drive circuits?	CO4	L4
24	Explain the terms over drive factor (ODF) and forced beta (β) for a power transistor in switching application.	CO3	L3
25	Name and explain various switching limits in case of power BJTs. With a circuit diagram, explain anti saturation control of BJT. Mention the improvement and drawback of this arrangement.	CO4	L4
26	Explain different methods of providing gate and base drive isolation.	CO4	L4
е	Experiences	_	-
1		CO1	L2
2			
3			
4		CO3	L3
5			

E1. CIA EXAM - 1

A. Model Question Paper - 1

Crs		15EC73	Sem:	7	Marks:	30	Time:	75 minut	es	
Cod	e:									
Cou	rse:	Power Ele	ctronics	I						
-	-	Note: An	swer any	[,] 3 questi	ons, each c	arry equ	al marks.	Mark	СО	Level
								S		
1	a	What are t	the advant	ages of st	atic power co	nverters	?	20	CO1	L1
	b	What are t	the periph	eral effect	s of power el	ectronics	system?		CO1	L2
	с	Explain th	e 2 mode	s of opera	tion of freewl	neeling d	iode.		CO2	L3
	d				ase control in	nproves t	he switching		CO1	L1
		performat	nce of a BJ	1.						
2	a	With the h	nelp of swi	tching wa	veforms expl	ain the sv	vitching times of	20	CO1	L2
		a power M	IOSFET.							
	b	Explain th	ne diode cl	naracterist	ics with diffe	rent regio	ons of operation		CO1	L4
	с	Write the	circuit dia	grams and	discuss the	methods	of providing		CO1	L3
		isolation o	of gate / b	ase circui	ts from powe	r circuits.				
	d	Give the a	pplication	s of BJT?					CO1	L2
3	a	Give the c	onstructio	on, static c	haracteristic,	and app	lications of IGBT	20	CO3	L1

AN INS		SKIT	Teaching Process	Rev I	No.: 1.0)
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	b	A diode circui	t is shown in figure with R=44 Ω and C=0.1 $\mu\text{F}.$ The		CO4	L2
		capacitor has	an initial voltage, $Vco=Vc(t=0)=220V$. If switch S1 is			
		closed at t=0,	determine (a) the peak diode current (b) the energy			
		dissipated in tl	he resistor R and (c) the capacitor voltage at $t=2\mu s$.			
	с	Give the symb	ol and characteristic features of the following devices		CO1	L1
		(I) SCR (II) IGB ⁻	T (iii) TRIAC (iv) SIT			
4	а	For the switchi	ng circuit shown below, calculate forced $\boldsymbol{\beta}$ of the	20	CO1	L2
		transistor. Also	p calculate the ODF if the manufacturer specified $\boldsymbol{\beta}$ is			
		10. Calculate t	he power loss PT of the transistor.			
		VCC = 100 V;	VB = 5 V ; RB =0.8 Ω ; RC =12 Ω ; VCE (Sat) = 1.0 V ;			
		VBE (Sat) = 1.0	V			
	b	What is the nee	ed for isolation of gate drive circuits?		CO1	L2
	с	Explain the ter	ms over drive factor (ODF) and forced beta (β) for a		CO1	L1
		power transist	or in switching application.			

b. Assignment -1

Note: A distinct assignment to be assigned to each student.

					Mode	Assignment (Que	stions				
Crs C	ode:	15EC73		Sem:	7	Marks:	5	/ 10	Time:	90 - 12	es	
Cours	se:	Power E	lectron	ics								
Note:	Each	student	to ans	wer 2–3 a	ssignmer	nts. Each assig	nme	ent carri	es equal n	nark.		
SNo	ι	JSN			Assignm	nent Descrip	tior	า		Marks	СО	Level
1			What a	re the adv	/antages	of static powe	r co	nverters	?	5	CO1	L3
2			What a	re the per	ipheral e	ffects of powe	r ele	ectronic	s system?	5	CO2	L4
3			Explair	n the 2 mo	odes of o	peration of fre	ewh	eeling o	liode.	5	CO2	L4
4			conver	•		different types o specify the f		•		5	C01	L3
5			-	s a switc	h. What	are the chara	cter	istics of	an ideal	5	C02	L4
6			Explair operat		de charao	cteristics with	dif	ferent r	egions of	5	C02	L4
7			&schot	tky diode:	. With th	ce between e help of neat ristics of a dio	dia	gram ex		5	CO2	L4
8				he help o with RC ar		diagram, exp d.	olair	n the w	orking of	5	CO2	L4
9			The ca switch curren	pacitor h S1 is clo	as an init osed at t energy di	n figure with F tial voltage, V =0, determine ssipated in th =2µs.	co= e (a)	Vc(t=0)) the pe	=220V. If eak diode	5	CO2	L4

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* BANG	SALORE*	Title:	Course Plan	Page:	14 / 27	
	t ©2017.	cAAS. All rights re		_		
10			e the symbol and characteristic features of the following vices (I) SCR (II) IGBT (iii) TRIAC (iv) SIT	5	CO1	L4
11			blain how anti saturation base control improves the tching performance of a BJT.	5	CO3	L3
12			h the help of switching waveforms explain the switching es of a power MOSFET.	5	CO4	L4
13		Giv	e the construction, static characteristic, and applications GBT.	5	CO3	L2
14		Wr pro	te the circuit diagrams and discuss the methods of oviding isolation of gate / base circuits from power cuits.	5	CO4	L4
15		Giv	e the applications of BJT?	5	CO4	L4
16		Dif	ferentiate between MOSFET and IGBT.	5	CO3	L5
17			y are IGBT becoming popular in their application to ntrolled converters?	5	CO3	L2
18		Wit	h the help of neat diagram explain the operation of BJT.	5	CO3	L3
19		Ex	plain the switching characteristics of MOSFET	5	CO3	L3
20		Ex	plain the driver circuit and protection circuits for MOSFET.	5	CO4	L4
21		the spe tra VC	the switching circuit shown below, calculate forced β of transistor. Also calculate the ODF if the manufacturer ecified β is 10. Calculate the power loss PT of the insistor. C = 100 V; VB = 5 V; RB =0.8 Ω ; RC =12 Ω ; VCE (Sat) = V; VBE (Sat) = 1.0 V	5	CO3	L3
22		Wh	at is the need for isolation of gate drive circuits?	5	CO4	L4
23			plain the terms over drive factor (ODF) and forced beta (β) a power transistor in switching application.	5	CO3	L3
24		BJT of	me and explain various switching limits in case of power s. With a circuit diagram, explain anti saturation control BJT. Mention the improvement and drawback of this angement.	5	CO4	L4
25			plain different methods of providing gate and base drive lation.	5	CO4	L4

D2. TEACHING PLAN – 2

Module - 3

Title:		Appr	16 Hrs
		Time:	
а	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Describe the types of thyristors, characteristics and their limitations.	CO5	L3
2	Analyze the gate control requirement to produce firing pulses and to	CO6	L4

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b	Course Schedule	2		
Class No	Module Cont	ent Covered	СО	Level
1	Thyristors: Int	roduction	CO5	L3
2	Thyristor Chai	CO5	L3	
3	-	or Model of Thyristor	CO5	L3
4	Thyristor Turr	i-On	CO5	L3
5	Thyristor Turr	n-Off	CO5	L3
6	A brief study o	on Thyristor Types	CO6	L4
7	Series Operati	on of Thyristors	CO6	L4
8	Parallel Opera	tion of Thyristors	CO6	L4
9	di/dt Protectio	on, dv/dt Protection, DIACs	CO6	L4
10	Thyristor Firir firing circuit	ng Circuits- R firing circuit, RC firing circuit, digital	CO6	L4
11	Unijunction Tr	ransistor.	CO6	L4
С	Application A	Areas	СО	Level
1	Thyristors are	CO6	L4	
	heating, dielee	ctric heating and lamp dimming.		
2	Thyristors are	CO6	L4	
	TRIAC's are us	sed in AC switches, starter circuit for lamps.	CO5	L3
d	Review Ques	stions	_	_
1	Compare the f	CO5	L3	
	-	uits. Give the applications where these devices are		
2	Draw the I-V	characteristics of SCR. Label the various voltages, ne operating modes on this sketch?	CO5	L3
3		e various methods by which thyristors be triggered into	CO5	L3
4	Define Latchin	ng and holding currents as applicable to an SCR? Show s on its state IV characteristics?	CO5	L3
5	Explain the sw and turn off p	vitching characteristics of a Thyristor during turn on rocess?	CO5	L3
6	Discuss the tw	vo transistor model of a Thyristor? Derive an expression current and discuss there from the turn-on	CO5	L3
7	Explain how th what are the c protection?	CO6	L4	
8	-	nsistor model, explain the switching action of a significance of gate control. Also derive the expression	CO6	L4

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	-		
	for anode current.		
9	Distinguish between: 1.) Latching current and Holding current, 2)	CO5	L3
	Converter grade thyristor and inverter grade thyristor, 3) thyristor		
	turn-off time and circuit turn-off time.		
10	The thyristor shown in the circuit below has a latching current of 20	CO5	L3
	mA and is fired by a gate pulse of 50 $\mu s.$ Show that without the		
	resistor R, the thyristor will fail to remain ON. Also find the maximum		
	value of R to ensure firing.		
11	With relevant diagram and waveforms, explain UJT relaxation	CO6	L4
	oscillator.		
12	Explain the following terms in brief with respect to SCR: i) Holding	CO5	L
	current; ii) Latching current; iii) di/dt rating; iv) dv/dt rating; v) PIV		
13	With neat sketches, explain turn-on and turn-off characteristics of	CO6	
	SCR.		
14	Explain in detail the following ratings of SCR – i) Average on state	CO6	
	current ii) RMS on state current iii) I2t rating iv) Peak working reverse		
	voltage v) Repetitive peak		
15	Design a UJT relaxation oscillator for triggering a SCR. The UJT has	CO6	
	the following specifications: $\eta=$ 0.7, Ip = 50 $\mu A,$ Vv = 2 V, Iv = 6mA,		
	VBB = 20 V, RBB = 7 $k\Omega$ and IEC = 2 mA. Also determine the limits		
	for the output frequency of the oscillator		
е	Experiences	_	_
1		CO1	L2
2			
3			
4		CO3	L3

Module - 4

Title:	Divide and Conquer	Appr	16 Hrs
		Time:	
а	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Understand the principle of operation and designing of single phase	C07	L3
	and three phase controlled rectifier by producing firing pulses.		
2	Design and analyse the AC voltage controller	CO8	L4
b	Course Schedule		
Class	Module Content Covered	CO	Level
No			
1	DC-DC Converters - Introduction, principle of step-down operation		
2	Step down converter analysis with RL load		

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		ep-up operation		
	step-up conve problems	erter with a resistive load		
	Performance p Converter clas			
	-	le regulators: Buck regulator		
	Boost regulato			
10	Buck-Boost Re	egulators.		
С	Application <i>I</i>	Areas	CO	Level
		ers are used in speed control of DC motor, Universal	C07	Level L3
	motors, lamp	-		LJ
	-	controllers are used in power generation, power	CO8	L4
		electric heating, induction heating, cyclo converters,		
	matrix convert	ters, Electric welding.		
-				
	Review Ques		-	-
	•	nase controlled rectifier with RL load, derive the r average and r.m.s values of output voltage with and	C07	L1
	-			
	without freewl			
	voltages in bo			
		e of freewheeling diode in a converter circuit.	C07	L3
	•	llating and non circulating current modes dual	CO8	L2
	converter.			
4		t of source impedance on performance of converters.	C07	L4
	• •	eration of single-phase Fully-controlled bridge		
		ng source impedance into account. Derive the 7 V∈ terms of overlap angle and source inductance.		
	-			
	_	and current waveforms.		
		of a neat diagram and associated wave forms, explain	CO8	L5
		of a single phase semi converter with RL load.		
	-	e full converter has a RL load having L = 6.5 mH, R =		L3
		10 V. The input voltage is V = 120 sin 120 π t.		
) the load current IL at wt = α = 600 (ii) the average		
		nt IA (iii) the r.m.s thyristor current IR (iv) the rms		
		t IRMS and (v) the average output current IDC.		
7		phase Full wave Mid point converter.		L1
8	-	Phase Half wave current with RLE load.		L4
9		Phase Full wave full Bridge converters.		
10	Discuss Single	Phase two pulse converter with Discontinuous load		
	current.			
	÷	Phase symmetrical and Asymmetrical Semi-converters		
	with the wavef	forms.		



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е	Experiences	_	_
1		C07	L2
2			
3			
4		CO8	L3
5			

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs Code:		15EC73	Sem:	7	Marks:	30	Time:	75	5 minut	es	
		Power Elec									
-	rse: -			2 questi	ons, each ca	nrry eq	ual marks.		Mark	CO	Level
									S		
1	a	-	-		rectifier with I				20	CO5	L1
		-		-	n.s values of	-	-				
			-	-	lso draw the v	wavefor	ms of the ou	itput			
			n both the								
	b	What is th	e use of fr	eewheelin	g diode in a c	onverte	r circuit.				L2
	C	Discuss Si current.	ngle Phase	e two puls	e converter w	ith Disc	ontinuous lo	ad		CO6	L3
	d	Discuss Si	ngle Phase	e symmetr	ical and Asym	metrica	al Semi–conv	erters			L1
		with the w	vaveforms.								
2	a	Compare	the feature	es of BJT, N	MOSFET and S	CR for	use in power		20	C07	L2
		electronic	circuits. C	live the ap	plications wh	ere the	se devices ar	e			
		preferred	over other	s.							
	b	Draw the	I-V charad	teristics o	of SCR. Label t	he vario	ous voltages,	,			L4
		current an	nd the ope	rating mod	des on this sk	etch?					
	c	Enumerat conductio		ous metho	ds by which t	hyristor	s be triggere	ed into			L3
	d		2	-	urrents as ap haracteristics		to an SCR? S	Show			L2
		these curr				• •					
3	a				del of a Thyri		•	ession	20	CO8	L1
					uss there fro	m the ti	urn-on				
		_	ms of a thy	·							
	b		•		protected aga			t ?		CO8	L2
		what are t protection		erations fo	or choosing ci	rcuit ele	ements for				
	С	Using two	transistor	model, ex	xplain the swi	tching a	action of a				L1
		thyristor a for anode	-	cance of g	ate control. A	lso deri	ve the expre	ssion			

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	d	Distinguish be	tween: 1.) Latching current and Holding current, 2)			L2
		Converter grad	le thyristor and inverter grade thyristor, 3) thyristor			
			and circuit turn-off time.			
4	a	With relevant o	liagram and waveforms, explain UJT relaxation	20		L2
		oscillator.				
	b	Explain the fol	lowing terms in brief with respect to SCR: i) Holding			L2
		current; ii) Late	ching current; iii) di/dt rating; iv) dv/dt rating; v) PIV			

	current; ii) Latching current; iii) di/dt rating; iv) dv/dt rating; v) PIV		
с	With neat sketches, explain turn-on and turn-off characteristics of		L1
	SCR.		
d	Explain in detail the following ratings of SCR – i) Average on state		L3
	current ii) RMS on state current iii) I2t rating iv) Peak working reverse		
	voltage v) Repetitive peak		

b. Assignment – 2

Note: A distinct assignment to be assigned to each student.

				Model As	ssignment Qu	estions				
Crs C	ode:	15EC73	Sem:	7	Marks:	5 / 10	Time:	90	0 – 120 mir	nutes
Cours	se:	Power Elect	ronics				·			
Note:	Each	student to	answer 2-3 a	ssignmer	nts. Each assig	Inment carr	ies equa	l mark.		
SNo	US	N	Ass	ignment	Description	1		Marks	CO	Level
1		Compar	e the features	of BJT, M	10SFET and SO	CR for use i	n	6	CO5	L3
		-	lectronic circu			ns where th	nese			
		devices	are preferred	over othe	ers.					
2		Draw th	ne I-V characte	eristics o	f SCR. Label tł	ne various		8	CO5	L3
		voltages	, current and	the oper	ating modes c	on this sket	ch?			
3		Enumer	ate the variou	s metho	ds by which th	yristors be		6	CO5	L3
		triggere	d into conduc	tion?						
4		Define L	atching and h	olding cı	urrents as app	licable to a	n SCR?	6	CO5	L3
		Show th	ese currents c	n its stat	e IV character	istics?				
5			the switching		ristics of a Th	yristor duri	ng	6	CO5	L3
		turn on	and turn off p	rocess?						
6			the two transi		•			6	CO5	L3
		-	ion for the and			s there fror	n the			
			mechanisms							
7		Explain	how thyristors	can be I	protected agai	nst dv/dt a	nd	6	CO6	L2
		di/dt?v	vhat are the co	onsiderat	ions for choo	sing circuit				
		element	s for protectio	n?						
8		-	vo transistor n		•	-		6	CO6	L2
		-	r and significa	-	ate control. Al	so derive th	ie			
		-	ion for anode							
9		Distingu	iish between:	1.) Latchi	ing current an	d Holding		6	CO5	L3

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The course than	. age		
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current, 2) Converter grade thyristor and inverter grade			
thyristor, 3) thyristor turn-off time and circuit turn-off time.			
The thyristor shown in the circuit below has a latching	6	CO5	L3
current of 20 mA and is fired by a gate pulse of 50 $\mu s.$ Show			
that without the resistor R, the thyristor will fail to remain			
ON. Also find the maximum value of R to ensure firing.			
With relevant diagram and waveforms, explain UJT relaxation	6	CO6	L2
oscillator.			
Explain the following terms in brief with respect to SCR: i)	6	CO5	L2
Holding current; ii) Latching current; iii) di/dt rating; iv) dv/dt			
rating; v) PIV			
With neat sketches, explain turn-on and turn-off	6	CO6	L2
characteristics of SCR.			
Explain in detail the following ratings of SCR – i) Average on	6	CO6	L2
state current ii) RMS on state current iii) I2t rating iv) Peak			
working reverse voltage v) Repetitive peak			
Design a UJT relaxation oscillator for triggering a SCR. The	8	CO6	L3
UJT has the following specifications: $\eta = 0.7$, Ip = 50 μ A, Vv =			
2 V, $Iv = 6mA$, $VBB = 20$ V, $RBB = 7$ k Ω and $IEC = 2$ mA. Also			
	 IZ. CAAS. All rights reserved. current, 2) Converter grade thyristor and inverter grade thyristor, 3) thyristor turn-off time and circuit turn-off time. The thyristor shown in the circuit below has a latching current of 20 mA and is fired by a gate pulse of 50 μs. Show that without the resistor R, the thyristor will fail to remain ON. Also find the maximum value of R to ensure firing. With relevant diagram and waveforms, explain UJT relaxation oscillator. Explain the following terms in brief with respect to SCR: i) Holding current; ii) Latching current; iii) di/dt rating; iv) dv/dt rating; v) PIV With neat sketches, explain turn-on and turn-off characteristics of SCR. Explain in detail the following ratings of SCR – i) Average on state current ii) RMS on state current iii) 12t rating iv) Peak working reverse voltage v) Repetitive peak Design a UJT relaxation oscillator for triggering a SCR. The UJT has the following specifications: η= 0.7, Ip = 50 μA, Vv = 	17. cAAS. All rights reserved. Current, 2) Converter grade thyristor and inverter grade thyristor, 3) thyristor turn-off time and circuit turn-off time. The thyristor shown in the circuit below has a latching 6 current of 20 mA and is fired by a gate pulse of 50 µs. Show that without the resistor R, the thyristor will fail to remain ON. Also find the maximum value of R to ensure firing. 6 With relevant diagram and waveforms, explain UJT relaxation oscillator. 6 Explain the following terms in brief with respect to SCR: i) 6 Holding current; ii) Latching current; iii) di/dt rating; iv) dv/dt rating; v) PIV 6 With neat sketches, explain turn-on and turn-off 6 characteristics of SCR. 6 Explain in detail the following ratings of SCR – i) Average on state current ii) RMS on state current iii) I2t rating iv) Peak working reverse voltage v) Repetitive peak 6 Design a UJT relaxation oscillator for triggering a SCR. The UJT has the following specifications: η= 0.7, Ip = 50 µA, Vv = 2 V, Iv = 6mA, VBB = 20 V, RBB = 7 kΩ and IEC = 2 mA. Also 8	17. cAAS. All rights reserved.10.1 mights reserved.current, 2) Converter grade thyristor and inverter grade thyristor, 3) thyristor turn-off time and circuit turn-off time.6The thyristor shown in the circuit below has a latching current of 20 mA and is fired by a gate pulse of 50 μ s. Show that without the resistor R, the thyristor will fail to remain ON. Also find the maximum value of R to ensure firing.6With relevant diagram and waveforms, explain UJT relaxation oscillator.6CO6Explain the following terms in brief with respect to SCR: i) Holding current; ii) Latching current; iii) di/dt rating; iv) dv/dt rating; v) PIV6CO6With neat sketches, explain turn-on and turn-off characteristics of SCR.6CO6Explain in detail the following ratings of SCR – i) Average on state current ii) RMS on state current iii) 12t rating iv) Peak working reverse voltage v) Repetitive peak8CO6Design a UJT relaxation oscillator for triggering a SCR. The UJT has the following specifications: $\eta = 0.7$, $lp = 50 \ \mu$ A, $Vv =$ 2 V, $lv = 6m$ A, $VBB = 20$ V, $RBB = 7 \ k\Omega$ and IEC = 2 mA. Also8

D3. TEACHING PLAN – 3

Module – 5

Title:	Divide and Conquer	Appr	16 Hrs
		Time:	
а	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Understand the principle of operation of step up and step down chopper by varying the duty cycle.	CO9	L4
2	Design and analyse the single phase and three phase DC-AC converters	CO10	L4
b	Course Schedule		
Class No	Module Content Covered	CO	Level
1	Pulse Width Modulated Inverters- Introduction	CO9	L2
2	principle of operation, performance parameters	CO9	L3
3	Single phase bridge inverters	CO9	L3
4	voltage control of single phase inverters,	CO9	L3
4	voltage control of single phase inverters,	005	_
5	current source inverters	CO9	L3
			L3 L3
5	current source inverters	CO9	

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9	DC Switches, Solid state relays	CO10	L2
10	Microelectronic relays	CO10	L2
16			
C	Application Areas	CO	Leve
1	Choppers are used in railway traction, battery charges, switched	CO9	L4
	capacitance filters, variable frequency drives, class D electronic		
	amplifiers, battery operated electric cars.		
2	Inverters are used in HVDC power transmission at the receiving end,	CO10	L4
	Uninterrupted power supply, Air conditioning, refrigeration,		
	synchronverters, electroshock weapons		
d	Review Questions	-	-
1	For a single phase controlled rectifier with RL load, derive the	CO9	L1
	expression for average and r.m.s values of output voltage with and		
	without freewheeling diode. Also draw the waveforms of the output		
	voltages in both the cases.		
2	What is the use of freewheeling diode in a converter circuit.	CO9	L3
3	Compare circulating and non circulating current modes dual	CO9	L2
	converter.		
4	Write the effect of source impedance on performance of converters.	CO9	L4
	Explain the operation of single-phase Fully-controlled bridge		
	converter taking source impedance into account. Derive the		
	expression for V∈ terms of overlap angle and source inductance.		
	Draw voltage and current waveforms.		
5	With the help of a neat diagram and associated wave forms, explain	CO9	L5
	the operation of a single phase semi converter with RL load.		
6	A single phase full converter has a RL load having $L = 6.5$ mH, $R = 0.5$	CO10	L3
	Ω and E = 10 V. The input voltage is V = 120 $$ sin 120 π t. Determine –		
	(i) the load current IL at wt = α = 600 (ii) the average thyristor		
	current IA (iii) the r.m.s thyristor current IR (iv) the rms output current		
	IRMS and (v) the average output current IDC.		
7	Discuss Single phase Full wave Mid point converter.	CO10	L2
8	Discuss Single Phase Half wave current with RLE load.	CO10	L2
9	Discuss Single Phase Full wave full Bridge converters.	CO10	L2
10	Discuss Single Phase two pulse converter with Discontinuous load	CO10	L2
	current.		
11	Discuss Single Phase symmetrical and Asymmetrical Semi-converters	CO10	L2
	with the waveforms.		
•	Experiences		
e	Experiences	-	-
1		CO10	L2

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4			CO9	L3		
5						

E3. CIA EXAM - 3

a. Model Question Paper - 3

Crs		15EC73	Sem:	7	Marks:	30	Time:	75 minut	es	
Code										
Cou	rse:	Power Ele	ctronics						1	
-	-	Note: An	swer any	2 questi	ons, each ca	arry equ	ial marks.	Mark s	СО	Level
1	a	expressio	n for avera eewheelin	age and r. g diode. A		output v	derive the oltage with and ns of the output	20	CO5	L1
	b	What is th	e use of fr	reewheelin	ig diode in a d	converte	r circuit.			L2
	с	Discuss Si current.	ngle Phas	e two puls	e converter w	ith Disco	ontinuous load		CO6	L3
	d	Discuss Si with the w	-	-	rical and Asyn	nmetrica	l Semi-converte	rs		L1
2	а	Compare electronic preferred		20	C07	L2				
	b	Draw the current ar			L4					
	с	Enumerat conductio	to		L3					
	d		-	-	currents as ap	-	to an SCR? Show			L2
3	a	for the an		nt and dise	del of a Thyri cuss there fro		rive an expressio rn-on	on 20	CO8	L1
	b	-	he consid		protected aga or choosing ci		dt and di/dt ? ments for		C08	L2
	с		and signifi		xplain the swi ate control. A	-	ction of a /e the expressio	n		L1
	d	_	grade thy	ristor and	inverter grad		ng current, 2) or, 3) thyristor			L2

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4	a	With relevant o	liagram and waveforms, explain UJT relaxation	20		L2	
		oscillator.					
	b	Explain the fol	lowing terms in brief with respect to SCR: i) Holding			L2	
		current; ii) Late	ching current; iii) di/dt rating; iv) dv/dt rating; v) PIV				
	с	With neat sket	ches, explain turn-on and turn-off characteristics of			L1	
		SCR.					
	d	Explain in deta	il the following ratings of SCR – i) Average on state			L3	
		current ii) RMS	on state current iii) I2t rating iv) Peak working reverse				
		voltage v) Repe	etitive peak				

b. Assignment – 3

Note: A distinct assignment to be assigned to each student.

					Model	Assignment	Quest	ions				
Crs C	ode:	15EC	74	Sem:	I	Marks:	5 /	10	Time:	90 - 120	minute	S
Cours	se:	Desig	gn and Ar	alysis of Alg	orithms							
Note:	Each	stude	ent to ans	wer 2–3 ass	ignment	ts. Each assig	nmer	nt car	ries equal ma	rk.		
SNo	U	SN		A	ssignn	nent Descri	ption			Marks	СО	Level
1			For a sin	gle phase co	ntrolled	rectifier wit	n RL l	oad, d	lerive the	8	CO9	L1
			-	-	-	.m.s values o		-	-			
				-		w the	wave	forms of the				
				oltages in bo								
2			What is t	he use of fre	ewheeli	ng diode in a	a conv	/erter	circuit.	4	CO9	L3
3			Compare converte	-	and non	circulating o	currer	nt mo	des dual	6	CO9	L2
4			Write the	effect of so	urce im	pedance on p	perfor	manc	e of	8	CO9	L4
			converte	rs. Explain tl	ne opera	ation of singl	e-pha	ase Fi	lly-controlled	ł		
			bridge co	onverter taki	ng sour	ce impedanc	e into	acco	unt. Derive			
			the expr	ession for V&	∈ term	s of overlap	angle	and s	source			
			inductan	ce. Draw vol	tage and	d current way	/eforr	ns.			CO9	
5			With the	help of a ne	at diagra	am and asso	ciated	l wave	e forms,	8	CO9	L5
			explain t load.	he operatior	ı of a sir	ngle phase se	emi co	onvert	er with RL			
6			A single	phase full co	onverter	has a RL loa	d hav	ing L	= 6.5 mH, R	8	CO10	L3
			= 0.5 Ω ä	and $E = 10 V$	'. The in	put voltage i	s V =	120	sin 120 π t.			
			Determir	ne – (i) the lo	ad curre	ent IL at wt =	$\alpha = 0$	6 0 0	(ii) the			
			average	thyristor cur	rent IA (iii) the r.m.s	thyris	stor cu	urrent IR (iv)			
				output curre	nt IRMS	and (v) the a	averag	ge out	tput current			
			IDC.									
7			Discuss S	Single phase	Full way	ve Mid point	conve	erter.		6	CO10	L2
8			Discuss	Single Phase	Half wa	ve current w	th RL	E load	1.	6	CO10	L2
9			Discuss S	Single Phase	Full way	ve full Bridge	conv	erters		6	CO10	L2
10			Discuss S current.	Single Phase	two pul	se converter	with	Disco	ntinuous load	l 6	CO10	L2

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11		Discus	s Single Phase symmetrical and Asymmetrical Semi-		6	CO10	L2	
		conver	ters with the waveforms.					

F. EXAM PREPARATION

1. University Model Question Paper

Cou	rse:	Power Elect	tronics				Month	/ Year	May /	2018
Crs	Code	15EC73	Sem:	7	Marks:	100	Time:		180	
								Mark s 20 20 onics with ion. 20 iode. overy th RC . The S1 is nergy		es
-	Note	Answer all	FIVE full ques	tions. All	questions carry	equal mar	ks.	Mark s	СО	Leve I
1	a	What are th	ne advantages	s of static	power converte	rs?		20	CO1	L3
	b	What are th	ne peripheral	effects of	power electron	ics system?			CO2	L4
	с	Explain the	2 modes of	operation	of freewheeling	diode.			CO2	L4
	d		•		rent types of fy the form of	-			CO1	L3
					DR					
-	a	Explain the	diode chara	cteristics w	vith different re	gions of op	eration.	20	CO2	L4
		What are th With the characteris		CO2	L4					
	С	With the he and RL load	-	diagram, e	xplain the work	ing of dioc	le with RC		CO2	L4
	d	capacitor h closed at t	nas an initial =0, determin	voltage, v ne (a) the	re with R=44 Vco=Vc(t=0)=2 peak diode cu t) the capacitor	20V. If sw rrent (b) tl	itch S1 is he energy		CO2	L4
2	a	Explain hov performand		ion base c	control improve	s the switcl	ning	20	CO3	L3
	b	With the he a power MC	-	ng wavefoi	rms explain the	switching	times of		CO3	L4
	с	Give the co	nstruction, s	tatic chara	cteristic, and a	oplications	of IGBT.		CO3	L2
	d		-		cuss the metho om power circui	-	ding		CO3	L4
				(DR					
-	a	What is the	need for iso	lation of g	ate drive circuit	:s?		20	CO4	L3
	b	-	e terms over o sistor in swite		r (ODF) and fore ication.	ced beta (β)	for a		CO4	L4
	с	a circuit dia	agram, explai	n anti satı	ng limits in case uration control s arrangement.	-			CO4	L2

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opyrig	ght ©201	7. cAAS. All rights reserved.			
	d	Explain different methods of providing gate and base drive isolation.		CO4	L4
		OR			
3	a	Give the applications of BJT?	20	CO5	L2
	b	Differentiate between MOSFET and IGBT.		CO5	L2
	с	Why are IGBT becoming popular in their application to controlled		CO5	L2
		converters?			
	d	With the help of neat diagram explain the operation of BJT.		CO5	L2
-	a	Why are IGBT becoming popular in their application to controlled	20	CO6	L2
		converters?			
	b	With the help of neat diagram explain the operation of BJT.		CO6	L3
	с	Explain the switching characteristics of MOSFET		C06	L3
	d	Explain the driver circuit and protection circuits for MOSFET.		CO6	L4
4	a	The thyristor shown in the circuit below has a latching current of 20	20	C07	L3
		mA and is fired by a gate pulse of 50 μ s. Show that without the			
		resistor R, the thyristor will fail to remain ON. Also find the maximum			
		value of R to ensure firing.			
	b	With relevant diagram and waveforms, explain UJT relaxation		C07	L2
		oscillator.			
	с	Explain the following terms in brief with respect to SCR: i) Holding		C07	L2
		current; ii) Latching current; iii) di/dt rating; iv) dv/dt rating; v) PIV			
	d	With neat sketches, explain turn-on and turn-off characteristics of		C07	L2
		SCR.			
		OR			
-	a	Explain the following terms in brief with respect to SCR: i) Holding	6	CO5	L2
		current; ii) Latching current; iii) di/dt rating; iv) dv/dt rating; v) PIV			
	b	With neat sketches, explain turn-on and turn-off characteristics of	6	CO6	L2
		SCR.			
	с	Explain in detail the following ratings of SCR – i) Average on state	6	CO6	L2
		current ii) RMS on state current iii) I2t rating iv) Peak working reverse			
		voltage v) Repetitive peak			
	d	Design a UJT relaxation oscillator for triggering a SCR. The UJT has	8	CO6	L3
		the following specifications: $\eta = 0.7$, Ip = 50 μ A, Vv = 2 V, Iv = 6mA,			
		VBB = 20 V, RBB = 7 k Ω and IEC = 2 mA. Also determine the limits			
		for the output frequency of the oscillator			
5	a	Give the applications of BJT?	20	CO9	L2
	b	Differentiate between MOSFET and IGBT.		CO9	L2
	c	Why are IGBT becoming popular in their application to controlled		CO9	L2
		converters?		_	
	d	With the help of neat diagram explain the operation of BJT.		CO9	L2
		OR			
	a	Why are IGBT becoming popular in their application to controlled	20	CO10	L2

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BAN	GALORE*	Title:	Doc Code:SKIT.Ph5b1.F02Date: 3-08-2019Title:Course PlanPage: 26 / 27AS. All rights reserved.Page: 26 / 27nverters?Image: 26 / 27th the help of neat diagram explain the operation of BJT.CO10plain the switching characteristics of MOSFETCO10	7							
Copyrig	Copyright ©2017. cAAS. All rights reserved.										
		converters?									
	b	With the help	of neat diagram explain the operation of BJT.		CO10	L3					
	c Explain the switching characteristics of MOSFET CO10										
	d	Explain the d	river circuit and protection circuits for MOSFET.		CO10	L4					

2. SEE Important Questions

	rse:	Power Elect					Month	/ Year	•	2018
Crs	Code	15EC73	Sem:	7	Marks:	100	Time:		180	
									minut	es
			-	stions. All	questions carry	equal marl	<s.< td=""><td>-</td><td>-</td><td></td></s.<>	-	-	
Mo dul e	Qno.	Important (Question					Mark s	CO	Yeai
1	1	Explain the	diode chara	cteristics v	vith different re	gions of op	eration.	6	CO2	
	2	With the		eat diagra	pn junction die m explain th		-		CO2	
	3	With the he and RL load	-	diagram, e	xplain the wor	king of diod	e with RC	6	CO2	
	4	capacitor h closed at t	rcuit is show nas an initial :=0, determi in the resisto	itch S1 is ne energy		CO2				
	5		-		rent types o fy the form of	-				
2	1	Explain how performanc		tion base c	control improve	s the switch	ning	6	CO3	
	2	With the he a power MC		ng wavefoi	rms explain the	switching	times of	7	CO4	
	3	Give the co	onstruction, s	tatic chara	cteristic, and a	pplications	of IGBT.	6	CO3	
	4		-		cuss the metho om power circu	-	ling	6	CO4	
	5	Explain diff	ferent metho	ds of provi	iding gate and	base drive i	solation.	8	CO4	
3	1	Give the ap	plications of	BJT?				6		
	2	Differentiat	te between M	IOSFET and	IGBT.			7		
	3	Why are IGI converters?	-	popular ir	n their applicati	on to contro	olled	6		
	4	With the he	elp of neat di	agram exp	lain the operat	ion of BJT.		6		
	5		drivor circui	t and prote	ection circuits f			8		1

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		Doc Code:	SKIT.Ph5b1.F02	Date: 3-08-2019			
		Title: Course Plan		Page: 27 / 27			
Copyrig 4	ht ©2017]	. cAAS. All rights reserved. The thyristor shown in the circuit below has a latching current of 20			C07		
-	-	-	ed by a gate pulse of 50 μ s. Show that without the	6			
			e thyristor will fail to remain ON. Also find the maximum				
		value of R to	-				
	2	With relevant	diagram and waveforms, explain UJT relaxation	7	C07		
		oscillator.					
			tches, explain turn-on and turn-off characteristics of	6	CO6		
		SCR.					
	4	Explain in detail the following ratings of SCR – i) Average on state			CO6		
			S on state current iii) I2t rating iv) Peak working reverse				
		voltage v) Rep	-				
				8	CO6		
		the following specifications: $\eta = 0.7$, Ip = 50 μ A, Vv = 2 V, Iv = 6mA,					
			$RBB = 7 k\Omega$ and IEC = 2 mA. Also determine the limits				
		for the outpu	t frequency of the oscillator				
5	1	For a single p	hase controlled rectifier with RL load, derive the	8	CO9		
		expression for average and r.m.s values of output voltage with and					
		without freew	heeling diode. Also draw the waveforms of the output				
		voltages in bo	oth the cases.				
	2	What is the us	se of freewheeling diode in a converter circuit.	4	CO9		
	3	Compare circ	ulating and non circulating current modes dual	6	CO9		
		converter.					
	4	Write the effe	ct of source impedance on performance of converters.	8	CO9		
		Explain the o	peration of single-phase Fully-controlled bridge				
		converter tak	ing source impedance into account. Derive the				
		expression fo	or V∈ terms of overlap angle and source inductance.				
		Draw voltage	and current waveforms.				
		-	of a neat diagram and associated wave forms, explain	8	CO9		
		the operation	of a single phase semi converter with RL load.				