MOHAMMED SATHAK A J COLLEGE OF ENGINEERING

Siruseri IT park, OMR, Chennai - 603103

LESSON PLAN

Department of Electrical and Electronics Engineering

Name of the Subject	POWER ELECTRONICS	Name of the handling Faculty	A.KAMALASELVAN
Subject Code	EE 8522	Year / Sem	III/V
Acad Year	2022-2023	Batch	2020-2024

Course Objective

To impart knowledge on the following Topics

• Different types of power semiconductor devices and their switching

• Operation, characteristics and performance parameters of controlled rectifiers

• Operation, switching techniques and basics topologies of DC-DC switching regulators.

• Different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.

• Operation of AC voltage controller and various configurations.

Course Outcome

CO1 Explain the significance of switching devices and its application to power converters and demonstrate the triggering circuit and

CO2 Compare the operation of two, three Pulse Converters and draw output waveforms with and without source and load inductance.

CO3 Classify the operation of Choppers and outline the application of SMPS.

CO4 Analyze the operation of single phase and three phase Inverters with and without PWM techniques.

CO5 Illustrate the operation of AC voltage controller and cycloconverter and its application.

Lesson Plan

Sl. No.	Topic(s)	T / R* Book	Periods Required	Mode of Teaching (BB / PPT / NPTEL / MOOC / etc)	Blooms Level (L1-L6)	CO	PO
UNIT I POWER SEMI-CONDUCTOR DEVICES							
1	Study of switching devices, SCR	T1,T2	1	BB, PPT	L1	CO1	PO1
2	TRIAC, GTO, BJT,	T1,T2	1	BB, PPT	L2	CO1	PO1,PO2
3	MOSFET, IGBT and IGCT	T1,T2	1	BB, PPT	L2	CO1	PO1,PO2
4	Static characteristics: SCR	T1,T2	1	BB, PPT	L1	CO1	PO1
5	Static characteristics: MOSFET	T1,T2	1	BB, PPT	L1	CO1	PO1
6	Static characteristics: IGBT	T1,T2	1	BB, PPT	L4	CO1	PO1,PO5
7	Triggering and commutation circuit for SCR	T1,T2	1	BB, PPT	L2	CO1	PO2
8	SCR Introduction to Driver	T1,T2	1	BB, PPT	L1	CO1	PO3
9	snubber circuits.	T1,T2,R5	1	BB, PPT	L1	CO1	PO1

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any :
Assignment on comparision of characteristics of switching devices

Evaluation method :
Conducting Quiz on power semi conductor devices

UNIT II PHASE-CONTROLLED CONVERTERS							
10	2-pulse converters	T1,T2	1	BB, PPT	L1	CO2	PO1
11	3-pulse pulse converters	T1,T2	1	BB, PPT	L4	CO2	PO1,PO5
12	6-pulseconverters	T1,T2	1	BB, PPT	L2	CO2	PO1,PO12
13	performance parameters	T1,T2	1	BB, PPT	L2	CO2	PO2
14	Effect of source inductance	T1,T2	1	BB, PPT	L1	CO2	PO1
15	Firing Schemes for converter	T1,T2	1	BB, PPT	L1	CO2	PO1
16	Dual converters	T1,T2	1	BB, PPT	L2	CO2	PO3
17	Applications-light dimmer	T1,T2,R5	1	BB, PPT	L3	CO2	PO2
18	Excitation system, Solar PV systems.	T1,T2,R5	1	BB, PPT	L3	CO2	PO2
Suggested Activity: Asssignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any : Case study on Solar PV system							
Evaluation method conducting quiz on AC to DC converters							
UNIT III DC TO DC CONVERTERS							
19	Step-down and step-up chopper	T1,T2	1	BB, PPT	L1	CO3	PO1,PO2,PO3
20	control strategy	T1,T2	1	BB, PPT	L1	CO3	PO1
21	Introduction to types of choppers-A, B, C	T1,T2	1	BB, PPT	L2	CO3	PO1
22	Introduction to types of choppers- D and E	T1,T2	1	BB, PPT	L2	CO3	PO2
23	Switched mode regulators	T1,T2	1	BB, PPT	L4	CO3	PO2,PO7
24	Buck regulator , Boost regulator	T1,T2	1	BB, PPT	L3	CO3	PO1
25	Buck- Boost regulator	T1,T2	1	BB, PPT	L3	CO3	PO1
26	Introduction to Resonant Converters	T1,T2	1	BB, PPT	L1	CO3	PO1
27	Applications-Battery operated vehicles	T1,T2,R5	1	BB, PPT	L3	CO3	PO1
Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any Assignments on Applications of DC to DC converters							
Evaluation method quiz on DC to DC converter							
UNIT IV INVERTERS							
28	Single phase and three phase voltage source inverters	T1,T2	1	BB, PPT	L3	CO4	PO1,PO2
29	120 degree mode and 180 degree mode of operation	T1,T2	1	BB, PPT	L2	CO4	PO1,PO2
30	Voltage& Harmonic control	T1,T2	1	BB, PPT	L1	CO4	PO1,PO2
31	PWM techniques Multiple PWM	T1,T2	1	BB, PPT	L1	CO4	PO1,PO2
32	Sinusoidal PWM	T1,T2	1	BB, PPT	L1	CO4	PO1,PO2

33	modified sinusoidal PWM	T1,T2	1	BB, PPT	L2	CO4	PO1,PO2
34	Introduction to space vector modulation	T1,T2	1	BB, PPT	L1	CO4	PO1,PO2
35	Current source inverter	T1,T2	1	BB, PPT	L1	CO4	PO1,PO2,PO4
36	Applications-Induction heating, UPS	T1,T2,R5	1	BB, PPT	L3	CO4	PO3

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any
Modified Control Technique in Solar-Based Inverter

Evaluation method :
paper based evaluation method in Modified Control Technique on Solar-Based Inverter

UNIT V AC TO AC CONVERTERS

37	Single phase AC voltage controllers	T1,T2	1	BB, PPT	L1	CO5	PO1
38	Three phase AC voltage controllers	T1,T2	1	BB, PPT	L2	CO5	PO2
39	Control strategy	T1,T2	1	BB, PPT	L1	CO5	PO1
40	Power Factor Control	T1,T2	1	BB, PPT	L1	CO5	PO1
41	Multistage sequence control	T1,T2	1	BB, PPT	L1	CO5	PO1
42	single phase cyclo converters	T1,T2	1	BB, PPT	L1	CO5	PO1
43	Three phase cyclo converters	T1,T2	1	BB, PPT	L2	CO5	PO2
44	Introduction to Matrix converters	T1,T2	1	BB, PPT	L1	CO5	PO1
45	Applications –welding	T1,T2,R5	1	BB, PPT	L3	CO5	PO3

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any :
New Trends and Technologies in Power Electronics and Motor Drives Education

Evaluation method :
Assignment on motor drives

Content Beyond the Syllabus Planned

1	Power management
2	Digital Control of High-Frequency Switched-Mode Power Converters

Text Books

1	M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, Third Edition, New Delhi, 2004.
2	P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003.
3	Ashfaq Ahmed 'Power Electronics for Technology', Pearson Education, Indian reprint, 2003.

Reference Books

1	Joseph Vithayathil,' Power Electronics, Principles and Applications', McGraw Hill Series, 6th Reprint, 2013.
2	Philip T. Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.
3	L. Umanand, "Power Electronics Essentials and Applications", Wiley, 2010.
4	Ned Mohan Tore. M. Undel and, William. P. Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.
5	S.Rama Reddy, 'Fundamentals of Power Electronics', Narosa Publications, 2014.
6	M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.
7	JP Agarwal," Power Electronic Systems: Theory and Design" 1e, Pearson Education, 2002.

Website / URL References

1	https://nptel.ac.in/courses/108/101/108101038/
2	https://nptel.ac.in/courses/108/108/108108036/
3	https://nptel.ac.in/courses/108/105/108105066/

Blooms Level

Level 1 (L1) : Remembering Level 2 (L2) : Understanding Level 3 (L3) : Applying	Lower Order Thinking	Fixed Hour Exams	Level 4 (L4) : Analysing Level 5 (L5) : Evaluating Level 6 (L6) : Creating		Higher Order Thinking	Projects / Mini Projects

Mapping syllabus with Bloom's Taxonomy LOT and HOT

Unit No	Unit Name	L1	L2	L3	L4	L5	L6	LOT	HOT	Total
Unit 1	Power Semi-conductor Devices	5	3	0	1	0	0	8	1	9
Unit 2	Phase- controlled Converters	3	3	2	1	0	0	8	1	9
Unit 3	DC to DC Converters	3	2	3	1	0	0	8	1	9
Unit 4	Inverters	5	2	2	0	0	0	9	0	9
Unit 5	AC to AC Converters	6	2	1	0	0	0	9	0	9
Total		22	12	8	3	0	0	42	3	45
Total Percentage		48.8889	26.7	17.78	6.66667	0	0	93.33	6.66667	100

CO PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1		1								3	3
CO2	3	3	1		1							1	3	3
CO3	3	2	1				1						3	3
CO4	3	3	2	2									3	3
CO5	3	3	2										3	3
Avg	3	2.8	1.4	2	1		1					1	3	3

Justification for CO-PO mapping

CO1	High correlation for PO1& PO2,low correlation for PO3&PO5 it is having application in Conventional Non Conventional energy.
CO2	High correlation for PO1&PO2, low correlation for PO3,PO5&PO12 and it is having life long learning . PSO 1& PSO2 having the societal environmental benefits
CO3	High correlation for PO1, Medium level correlation for PO2 & low level Correlation for PO3& PO7 , it is related with PSO1 & PSO2 , it is having application in the design of Electric Vehicle .
CO4	High correlation for PO1, PO2 Medium level correlation for PO3&PO4 , it is related with PSO1 & PSO2 and its applicable in design of Electric Vehicle .
CO5	High correlation for PO1, PO2 medium level correlation for PO3, can be able to design an electrical equipment , correlation for PSO2 is given as filters are required for the design of Electric vehicles.

3	High level	2	Moderate level	1	Low level

Name & Sign of Faculty Incharge : Mr.A.Kamalaselvan

Name & Sign of Subject Expert ::Dr.J.Jeha

Head of the Department :Dr.J.Jeha

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