

Kadi Sarva Vishvavidyalaya, Gandhinagar
Bachelor of Engineering (Electrical Engineering Syllabus)
B.E Semester: Vth (EE)
Electrical Engineering
Subject Name & Code: Power Electronics (EE-504)

Course Objective:

The educational objectives of this course are

- To understand basic power electronic devices and their role in power conversion
- To study basic topologies of various converter.

A. Teaching / Examination Scheme

SUBJECT		Teaching Scheme				Total Credit	Examination Scheme					Total Mark s
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
EE-504	Power Electronics	4	0	2	6	5	3	70	30	20	30	150

Power Semiconductor Devices:

Introduction, Scope and Application, Classification of Power Converters, Construction and characteristics of Thyristors, MOSFET, IGBT, IGCT and GTO, Comparison of Controllable switches.

Phase Controlled (AC to DC) Converters (Rectifiers):

Principle of phase control, Full-wave controlled Converters. Single phase full wave converters, Single phase two pulse converters with discontinuous load and its performance, three phase thyristor converters: half wave, full and semi converters. Dual Converters. Effect of source impedance on performance of converter.

DC to DC Converters (Choppers):

Introduction, Classification, Principle and Operation, Control strategies, Chopper configurations, Thyristor chopper circuits, Jones chopper, Morgan chopper, AC (Multiphase) chopper, **Switched mode power supply:** step down (buck), Step up (boost) and step down/step up (buck/boost) converters and Cuk converter.

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DC to AC Converters (INVERTERS)

Introduction, Classification, single phase half and full bridge VSI, three phase VSI 120 and 180 degree conduction mode. Performance Parameters of Inverter, Voltage control of single phase and three phase Inverter, Series inverter, Parallel inverter, Current source inverter.

AC Voltage Controllers:

Introduction, Principle of On-Off control and Phase Control, Single phase Bidirectional Controllers with R and R-L Loads, Three phase full wave controllers

Cycloconverters:

Single Phase and Three phase Cycloconverter and Matrix Converter

Application of Power Electronics: D.C. Motor Speed control, A.C. Drives: variable frequency drives. AC Voltage Regulators.

INSTRUCTIONAL METHOD AND PEDAGOGY (Continuous Internal Assessment (CIA) Scheme)

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures, practical's and Tutorial which carries 05 Marks.
- At regular intervals assignments are given. In all, a student should submit all assignments of 05 marks each.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries 05 Marks.
- Viva Voce will be conducted at the end of the semester of 05 Marks.
- One internal exam of 30 marks is conducted as a part of mid semester evaluation.
- Experiments shall be performed in the laboratory related to course contents.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.

STUDENTS LEARNING OUTCOME:

On successful completion of the course

- The student can learn about various methods of topologies of power conversion.

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B. Lesson Planning

SR No.	Lectures (Hours)	Weightage in % in Exam	Topic
1	06	10	Power Semiconductor Devices: Introduction, Scope and Application, Classification of Power Converters, Construction and characteristics of Thyristors, MOSFET, IGBT, IGCT and GTO, Comparison of Controllable switches.
2	12	20	Phase Controlled (AC to DC) Converters (Rectifiers): Principle of phase control, Full-wave controlled Converters. Single phase full wave converters, Single phase two pulse converters with discontinuous load and its performance, three phase thyristor converters: half wave, full and semi converters. Dual Converters. Effect of source impedance on performance of converter.
3	12	20	DC to DC Converters (Choppers): Introduction, Classification, Principle and Operation, Control strategies, Chopper configurations, Thyristor chopper circuits, Jones chopper, Morgan chopper, AC (Multiphase) chopper, Switched mode power supply : step down (buck), Step up (boost) and step down/step up (buck/boost) converters and Cuk converter.
4	15	25	DC to AC Converters (INVERTERS) Introduction, Classification, single phase half and full bridge VSI, three phase VSI 120 and 180 degree conduction mode. Performance Parameters of Inverter, Voltage control of single phase and three phase Inverter, Series inverter, Parallel inverter, Current source inverter.
5	12	20	AC Voltage Controllers: Introduction, Principal of On-Off control and Phase Control, Single phase Bidirectional Controllers with R and R-L Loads, Three phase full wave controllers. Cycloconverters: Single Phase and Three phase Cycloconverter and Matrix Converter
	03	05	Application of Power Electronics: D.C. Motor Speed control, A.C. Drives: variable frequency drives. AC Voltage Regulators.
	60	100	

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C. Instructional Method & Pedagogy

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
- Attendance is compulsory in lectures, which may carries five marks in overall evaluation.
- One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.

Students Learning Outcomes

On successful completion of the course, student should be able to apply power electronics topology for power conversion.

TEXT BOOK:

1. [Ned Mohan](#), [Tore M. Undeland](#), 'Power electronics: converters, applications, and design', John Wiley & Sons., 3rd edition.
2. P. S. Bimbhra, "Power Electronics", Khanna Publishers, New Delhi.
3. M.D. Singh, K B Khanchandani, 'Power Electronics', second edition, TATA McGraw Hill.

REFERENCE BOOKS:

1. Muhammad H. Rashid , "Power Electronics - circuits, devices and applications", Prentice Hall of India, 2nd edition.
2. Power Electronics – Devices, Converters and Applications", by Vedam Subramanyam Revised 2nd edition, New Age Publications.
3. Thyristorised controller by Dubey, Joshi & Doradla, New age Publication.
4. B. K. Bose, 'Modern Power Electronics & AC Drives', Prentice Hall India.