POWER CONVERTERS & APPLICATIONS (MINOR)

Course Code:20EEM102

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PREREQUISITES: Basic Electrical and Electronics Engineering & Principles of Electrical Engineering

COURSE OUTCOMES:

At the end of the Course, the Student will be able to:

CO-1: Understand different types of power semiconductor devices and their characteristics (L2)
CO-2: Explain the operation of Single and Three Phase controlled Rectifiers. (L2)
CO-3: Explain the operation of DC-DC Converters(L2)
CO-4: Describe the operation of various DC-AC Inverters (L3)
CO-5: Explain the operation of AC voltage controllers (L2)

UNIT-I: POWER SEMICONDUCTOR DEVICES (10 Lectures)

Power Diode, Power BJTs, Power MOSFETs, IGBTs, GTOs and SCR with their Static characteristics, Two transistor model of SCR. SCR Turn on and SCR turn off characteristics.

Learning Outcomes: The Student will be able to

1. Understand different types of power semiconductor devices and their characteristics (L2)
2. Describe the two transistor model of thyristor(L2)
3. Explain the turn on and turn off characteristics of thyristors (L2)

UNIT-II: PHASE CONTROLLED RECTIFIERS (10 Lectures)

1-PHASE CONTROLLED AC/DC RECTIFIERS: Principle of phase angle control: Single phase half and full controlled converter with R & R-L load

3-PHASE CONTROLLED AC/DC RECTIFIERS: Three phase half controlled converter with R and R-L load, Three phase Full controlled converter with R and RL load and Applications

Learning Outcomes: The Student will be able to

1. Explain the principle of phase angle control (L2)
2. Explain the principle of operation of single phase controlled Rectifiers(L2)
3. Explain the principle of operation of Three phase controlled Rectifiers (L2)

UNIT-III: DC-DC CONVERTERS (10 Lectures)

Principle of chopper operation, Control Strategies, Step Down and Step Up choppers (Simple Problems) and Applications

Learning Outcomes: The Student will be able to

1. Understand the principle of chopper control (L2)
2. Explain the principle of operation Step down chopper (L2)
3. Explain the principle of operation of Step up chopper(L2)

UNIT-IV: DC – AC CONVERTERS (10 Lectures)

Single phase half bridge inverter, Single phase full bridge inverter, Three phase voltage source inverters (120 degree conduction modes).

VOLTAGE CONTROL TECHNIQUES OF INVERTERS: Single Pulse Width Modulation, Multiple Pulse-width Modulation, Sinusoidal Pulse width Modulation and Applications-UPS and SMPS

Learning Outcomes: The Student will be able to

1. Explain the principle of operating of inverters (L2)
2. Describe the different types of modulation techniques(L2)
3. Determine the performance parameters of inverters (L3)

UNIT-V: AC VOLTAGE CONTROLLERS: (10 Lectures)

Principle of on-off control, Principle of phase angle control, Single phase bidirectional controllers with R and RL loads and Applications

Learning Outcomes: The Student will be able to

1. Understand the principle of phase angle control (L2)
2. Explain the principle of operation Single phase bidirectional controllers with R load (L2)
3. Explain the principle of operation of Single phase bidirectional controllers with RL load (L2)

TEXT BOOKS:

1. M. H. Rashid, Power Electronics: Circuits, Devices and Applications, Prentice Hall of India 4th th Edition, 2017

REFERENCES:

1. Elements of Power Electronics, Philip T. Krein, Oxford University Press, Indian Edition, Second edition, 1 November 2017.
2. Ned Mohan, Tore M. Undeland, “Power Electronics - Converters, Applications and Design”, Wiley India Edition, 3rd Edition, 2015.

WEB REFERENCES:

Lecture Series on Power Electronics by Prof. B.G. Fernandes, Department of Electrical Engineering, IIT Bombay.

https://nptel.ac.in/courses/108/101/108101038/