

## B.Tech III Year I Semester

## JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEE53- POWER ELECTRONICS

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**Course Objectives:**

- Understand the operation, characteristics and usage of basic Power Semiconductor devices.
- Analyze controlled rectifier circuits.
- Analyze the operation of DC-DC choppers.
- Analyze the operation of voltage source inverters.
- To Understand the concept of AC voltage controllers and cycloconverters

**UNIT – I: POWER SWITCHING DEVICES****10 Hrs**

Diode, Thyristor, Triac, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT, Simple forced commutation circuits, Numerical Problems

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the basic power semiconductor devices **L1**
- Understand in detail about SCR, MOSFET and IGBT **L2**

**UNIT – II: THYRISTOR RECTIFIERS****10 Hrs**

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor-Numerical problems.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learn about the concepts of single phase control converters. **L1**
- Learn about the concepts of three phase control converters. **L2**

**UNIT – III: DC- DC CONVERTERS****10 Hrs**

power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage - Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage - Power circuit of the converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage - Numerical problems

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learn the concepts of Buck DC-DC converter **L1**
- Learn the concepts of Boost and Buck-boost DC-DC converters **L2**

**UNIT – IV: INVERTERS****10 Hrs**

Single phase Voltage Source inverters –operating principle- steady state analysis, McMurray and McMurray Bedford inverters, Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle of operation only, Three phase bridge inverters (VSI) – 180 degree mode–120 degree mode of operation, Sine triangle PWM, Numerical problems.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learn about the working of single phase inverters **L1**
- Learn about the working of three phase inverters **L2**

**UNIT – V: AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS**

**10 Hrs**

AC voltage controllers – Principle of phase control, Principle of integral cycle control – With R and RL loads, Numerical problems. Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down cyclo converters with Resistive and inductive load, Principle of operation, Waveforms, output voltage equation.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learn the concept of AC voltage controllers L1
- Learn the concept of Cyclo Converters L2

**Text Books:**

1. Power Electronics: Circuits, Devices and Applications by M.H.Rashid, Prentice Hall of India, 2nd edition, 1998
2. Power Electronics by P.S.Bimbhra, Khanna Publishers, 4th Edition, 2010.
3. Power Electronics by M.D.Singh&K.B.Kanchandhani, Tata McGraw Hill Publishing Company, 1998.

**Reference Books:**

1. Power Electronics, A first Course by Ned Mohan, Wiley, 2011.
2. Fundamentals of Power Electronics by Robert W. Erickson and Dragan Maksimovic, Kluwer Academic Publishers, 2nd Edition, 2004.
3. Power Electronics by V.R.Murthy, OXFORD University Press, 1st Edition, 2005.
4. Power Electronics by VedamSubramanyam, New Age International(P) Limited, 1996.
5. Power Electronics by P.C.Sen, Tata McGraw Hill Education, 1987.

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the operation, characteristics and usage of basic Power Semiconductor Devices. L1
- Understand different types of Rectifier circuits with different operating conditions L2
- Understand DC-DC converters operation and analysis of their characteristics. L3
- Understand the construction and operation of voltage source inverters, Voltage Controllers and CycloConverters. L4
- Understand the construction and operation of Voltage Controllers and CycloConverters. L5