

**B.Tech IV Year I Semester****JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA****19AEE74a- SWITCHED MODE POWER CONVERTERS****(Professional Elective-III)**

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**Course Objectives:** The objectives of the course are to make the students learn about

- Understand basic concepts of DC-DC converters
- Understand the concepts of resonant converters and their classification, various types of multilevel inverters, power conditioners, UPS and filters.
- Apply various modulation and harmonic elimination techniques over the converters.
- Analyze the state space modeling of various types of converters.
- Design inductor and transformer for various power electronic applications.

**UNIT – I: DC-DC Converters****10 Hrs**

Principles of step down and step up converters – Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters – Numerical Examples

**Learning Outcomes:**

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

- Understand state space modeling of DC-DC converters. **L1**
- Distinguish between step down and step up converters. **L2**

**UNIT – II: Switching Mode Power Converters****10 Hrs**

Analysis and state space modeling of fly back, Forward, Luo, Half bridge and full bridge converters- control circuits and PWM techniques – Numerical Examples

**Learning Outcomes:**

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

- Know about state space modelling of converters **L1**
- Understand about various control circuits & PWM techniques **L2**

**UNIT – III: Resonant Converters****10 Hrs**

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS, Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control – Numerical Examples

**Learning Outcomes:**

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

- Classification of resonant converters. **L1**
- Distinguish between series and parallel resonant converters. **L2**

**UNIT – IV: DC-AC Converters****10 Hrs**

Single phase and three phase inverters, control using various (sine PWM, SVPWM and advanced modulation) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

**Learning Outcomes:**

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

- Understand and analyze different single phase and three phase inverters –modulation & harmonic elimination techniques. **L1**
- Understand various types of multilevel inverters with waveforms and their applications **L2**

**UNIT – V: Power Conditioners, UPS & FILTERS****10 Hrs**

Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

**Learning Outcomes:**

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

- Understand different types of power line disturbances, power conditioners, in detail working of UPS and its applications. **L1**
- Understand various types of filters with and without capacitors & inductor and transformer for various power electronic applications. **L2**

**Text Books:**

1. L. Umanand, “Power Electronics: Essentials and Applications”, Wiley, 2009
2. M.H. Rashid, “ Power Electronics handbook”, Elsevier Publication, 2001.
3. V Ramanarayanan, “Course material on Switched Mode Power Conversion” Dept. of Electrical Engg. IISc. Bangalore.

**Reference Books:**

1. Philip T. Krein, “Elements of Power Electronics”, Oxford University Press, 2012
2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, “Power Electronics converters, Applications and design”, 3rd Edition, John Wiley and Sons,2006
3. M.H. Rashid, “Power Electronics circuits, devices and applications”, 3<sup>rd</sup> Edition Prentice Hall of India New Delhi, 2007

**Course Outcomes:**

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

- To be able to solve the problems and to design of various DC-DC converters **L1**
- To be able to understand advanced converters of SMPCs **L2**
- To understand the performance of resonant converters **L3**
- To understand various types and performance characteristics of 1- $\phi$  and 3- $\phi$  inverters with single/multi levels **L4**
- To understand about power conditioners, UPS and filters&PE applications **L5**