

B.Tech III Year I Semester**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA****19AEC54b- INDUSTRIAL ELECTRONICS****(Professional Elective-I)**

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

- To learn the construction, working and applications of power transistors and thyristors.
- To gain knowledge about Power MOSFETs and different types of protection circuits.
- To study the operation of Rectifiers, Inverters, Relays and Timers.
- To know about the industrial applications of electronics in welding and heating.
- To understand the industrial applications of Ultrasonics.

UNIT – I: Power Bipolar Junction Transistors and Thyristor Power Devices**10 Hrs**

Introduction, Transistor Structures, Current-Voltage Characteristics, Second Breakdown, Safe Operating Area (SOA), Fabrication of Power Transistors, Power derating, Polarized Snubber.

Thyristor Structure, Thyristor Turn-on and Turn-off Methods, Thyristor Ratings, SCR Applications, Light Activated Silicon Controlled Rectifier (LASCR), Shockley Diode, Diac and Triac, Uni Junction Transistor(UJT), UJT Relaxation Oscillator, Full Wave Phase Control Circuit, Programmable UJT(PUT) Complementary UJT (CUJT), The Silicon Controlled Switch (SCS), Gate Turn Off Thyristors (GTO), Gate Drive Circuits.

Learning Outcomes:

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

- Gain knowledge on working of power transistors and thyristors. **L1**
- Understand the industrial applications of power transistors and thyristors. **L2**

UNIT – II: Power Switching Devices and Protection Circuits**10 Hrs**

Power MOSFETs, Power Semiconductor Switches, Power Semiconductor Materials, Power Integrated Chips (PIC).

Power MOSFETs, Power Semiconductor Switches, Power Integrated Chips (PIC), Cooling & Heat Sinks Protection of Semiconductor Devices, Gate Protection Circuits, Gate Drive Circuits, Protection of Power Transistors, Series and Parallel Connection of Thyristors.

Learning Outcomes:

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

- Understand the working of Power MOSFETs, Switches & Integrated Chips.(L2) **L2**
- Know the importance of Heat Sinks & Protection circuits.(L1) **L1**

UNIT – III: Rectifiers And Inverters**10 Hrs**

Flywheel Diode, Half-Wave Rectifier Circuit with Inductive Load, Single Phase Full Wave Rectifier Circuit with RL Load, Poly Phase Rectifiers, Three Phase Rectifier with Delta-Star Connected Transformer, Six Phase Half-Wave Rectifier, Controlled Poly Phase Rectifiers, Effect of Inductance, Voltage Multiplier Circuit Inverters, Thyristorized Inverters, Series Type Inverter, Modified Series Inverter, McMURRAY-BEDFORD Inverter Bridge.

Relays And Timers

Basic Construction of Relays, AC relays, RC Charging & Discharging Circuits, UJT/SCR, AC & Precisor Long Time Delay Relays, Integrated Circuit Timers, Synchronous Timer, Sequence Timer Employing 555.

Learning Outcomes:

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

- Explain the working of multiphase rectifiers and inverters. **L2**
- Know the industrial applications of relays and timers. **L1**

UNIT – IV: INDUSTRIAL APPLICATIONS – I**10 Hrs**

Resistance Welding Controls: Introduction, Resistance welding process, Basic Circuit for A.C. resistance welding, Types of Resistance welding, electronic welding control used in Resistance welding, Energy storage welding.

Induction Heating: Principle of induction heating, Theory of Induction heating merits of induction heating Application of induction heating, High frequency power source of induction heating.

Dielectric Heating: Principle of dielectric heating, theory of dielectric heating, dielectric properties of typical materials, electrodes used in dielectric heating, method of coupling of electrodes to the R.F. generator, Thermal losses in Dielectric heating, Applications.

Learning Outcomes:

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

- Understand different types of resistance welding processes and controls. **L2**
- Appreciate the industrial applications of induction heating & dielectric heating. **L1**

UNIT – V: INDUSTRIAL APPLICATIONS – II**10 Hrs**

Ultrasonics: Introduction, Generation of Ultrasonic waves, Application of Ultrasonic waves, Ultrasonic stroboscope, ultrasonic as means of communication, ultrasonic flaw detection, Optical image on non-homogeneities, ultrasonic study of structure of matter, Dispersive study of structure of matter, Dispersive and colloidal effect of Ultrasonic, Coagulating action of Ultrasonic, separation of mixtures by ultrasonic waves cutting and machining of hard materials by ultrasonic vibrations, Degassing of liquids by ultrasonic waves Physico-chemical effects of ultrasonics, chemical effects of ultrasonics, Thermal effects of Ultrasonics soldering and welding by ultrasonics, Ultrasonic Drying.

Learning Outcomes:

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

- Understand the generation & applications of Ultrasonics. **L2**
- Learn the chemical and thermal effects of Ultrasonics. **L1**

Text Books:

1. G. K. Mithal, "Industrial Electronics", Khanna Publishers, 2000.
2. J. Gnanavadeivel, R. Dhanasekaran and P. Maruthupandi, "Industrial Electronics", Anuradha Publications, 2011.
3. S. N. Biswas, "Industrial Electronics", Dhanpat Rai & Co.

Reference Books:

1. M. Rammurthy, "Thyristors and Applications", East-West Press, 1977.
2. F. D. Petruzulla, "Industrial Electronics", McGraw Hill, Singapore, 1996.
3. M. H. Rashid, "Power Electronics Circuits, Devices and Application", 3rd Ed., PHI, 2004.

Course Outcomes:

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

- Understand the construction, working and applications of power transistors and thyristors. **L2**
- Know about Power MOSFETs and different types of protection circuits. **L1**
- Appreciate the working of Rectifiers, Inverters, Relays and Timers. **L1**
- Know the industrial applications of electronics in welding and heating. **L1**
- Understand the industrial applications of Ultrasonics. **L2**