

Course Syllabi: UEE504 Power Electronics (L : T : P :: 3 : 1 : 2)

1. **Course number and name:** UEE504; Power Electronics

2. **Credits and contact hours:** Credits: 4.5; Hours: 6

3. **Text book, title, author, and year**

- *Dubey, G.K., Doradla, S.R., Joshi, A. and Sinha, R.N.K., Thyristorised Power Controllers, New Age International (P) Limited, Publishers (2004).*
- *Rashid, M., Power Electronics, Prentice–Hall of India Private Limited (2006).*
- *Mohan, N., Undel, T.M. and Robbins, W. P., Power Electronics: Converter Applications and Design, John Wiley and Sons (2007).*
- *Jain, A., Power Electronics and its Applications, Penram International Publishing (India) Pvt. Ltd. (2008).*

a. Other supplemental materials

- Nil

4. **Specific course information**

a. Brief description of the content of the course (catalog description)

Introduction: Review of power semiconductor devices, their characteristics, Thyristors, Their static and dynamic characteristics, Turn-on and Turn - off methods and circuits, Ratings and protection of SCRs, Other members of Thyristor family, Series and Parallel operation of thyristors, Firing circuits for SCRs.

Phase Controlled Converters: Principle of Phase Control, Single Phase Half Wave Circuit with Different Types of Loads, Single Phase and Three Phase Semi Converter and Full Converter Bridge Circuits with Line Commutation, Continuous and Discontinuous Conduction Effect of Source Inductance on Single Phase and Three Phase Full Converters, Single Phase and Three Phase Dual Converters and Their Operation with Circulating and Non Circulating Currents.

DC Choppers: Principle of chopper operation, Control strategies, Types of choppers, Step up and step down choppers, Types of choppers, Steady state time domain analysis with R, L, and C type loads, Voltage, Current and Load commutated Choppers.

Inverters: Single phase VSI, Half Bridge and Full Bridge Inverters and their steady state analysis, Modified McMurray Half Bridge Inverter, Series and Parallel Inverters, and Three Phase Bridge Inverters with 180° and 120° modes. Single-phase PWM Inverters. Current Source Inverters, CSI with R load (qualitative approach).

AC Voltage Controllers: Types of single-phase voltage controllers, Single-phase voltage controller with R and RL type of loads. Three phase voltage controller configurations R Load.

Cycloconverters: Principles of operation, Single phase to single phase step up and step down Cycloconverters. Three phase to single phase and three-phase to three-phase Cycloconverters, Output voltage equation for a Cycloconverter.

Laboratory Work: SCR V-I characteristics, Methods of turning on of an SCR through gate triggering, DC -DC Chopper, Solid state fan regulator, Semi Converter and Full Converter with R and RL type of loads, DC Shunt Motor Speed Control, Single phase AC voltage controller with R load, Simulation of all Converters using software CASPOC.

5. **Specific goals for the course**

After the completion of the course, the students will be able to:

- Identify the power – electronic devices and inference their usage as switch for energy conversion and control.
- Select and design appropriate converter configuration / topology for typical power application such as DC drive, AC drive, HVDC and FACTS.
- Design the firing and commutation circuit for different converter configurations.
- Use power converters for harmonic mitigation, voltage and frequency control.

6. Brief list of topics to be covered

- Phase Controlled Converters
- DC Choppers
- Inverters
- AC Voltage Controllers
- Cycloconverters