**EE 785 07**

**Course Objectives:**

1. To get an overview of different types of power semi-conductor devices and their switching characteristics.
2. To understand the operation, characteristics and performance parameters of controlled rectifiers.
3. To study the operation, switching techniques and basic topologies of Choppers.
4. To learn the different modulation techniques of pulse width modulated inverters and to understand the harmonic reduction methods.
5. To study simple applications
6. **Power Semi-conductor Devices[9 hours]**
   1. Introduction
   2. Power Diodes
   3. Power BJT
   4. Thyristor Characteristics
   5. Two Transistor model of Thyristor
   6. Series and Parallel operation of Thyristors
   7. SCR, TRIAC, Power MOSFET, GTO, IGBT and SIT
      1. Device Structures and Characteristics
      2. Turn ON- Turn OFF methods and Circuits
      3. Protections, Ratings and applications
      4. Handling precautions and power dissipation

1. **Controlled Rectifiers[8 hours]**
   1. Single Phase / Three Phase, Half wave / full wave, half controlled /fully controlled converters with R, RL and RLE loads
   2. Continuous and discontinuous current operations
   3. Evaluation of performance parameters
   4. Effects of source inductance
   5. Power factor improvement techniques
   6. 6-pulse and 12-pulse converters
   7. Dual converters

1. **Choppers[11 hours]**
   1. DC Choppers
      1. Introduction
      2. Principle of operation,
      3. Analysis with waveforms of Step-Down and Step-Up choppers
      4. Buck, boost and buck-boost Converter
   2. AC Choppers:
      1. Operation of 1-phase voltage regulator with R, RL loads
      2. 1-phase step up & step down cycloconverters

1. **Inverters[9 hours]**
   1. Single phase and three phase (both 120º mode and 180ºmode) inverters
   2. PWM techniques: Sinusoidal PWM, modified sinusoidalPWM, multiple PWM
   3. Introduction to space vector modulations
   4. Voltage and harmonic control
   5. Series resonant inverter
   6. Current source inverter

1. **Applications[8 hours]**
   1. Speed control of DC motor using rectifiers and choppers
   2. Uninterruptible Power Supply (UPS)
   3. Switched mode Power Supply (SMPS)
   4. Battery Charger
   5. Introduction to shunt and series compensators

**Practical:**  
There should be experiments on

1. Basic characteristics of power transistors, diodes thyristors (SCRs)
2. Single phase, full wave and bridge rectifiers with resistive loads
3. Single phase SCR controller with UJT trigger
4. Three phase bridge rectifiers with diodes and with SCRs
5. Rectification for inductive loads
6. Various types of Choppers
7. Speed Control of DC Motor

**References:**

1. M.H. Rashid, “Power Electronics: Circuits, Devices and Applications”, Pearson Education.
2. Philip T. Krein, “Elements of Power Electronics”, Oxford University Press.
3. Jay P. Agarwal, “Power Electronic Systems – Theory and Design”, Prentice Hall.
4. Ned Mohan, Tore M. Undeland, William P. Robbins, “Power Electronics, Converters, Application and Design”, John Wiley and Sons.
5. Cyril.W.Lander, “Power Electronics”, McGraw – Hill.
6. M.D. Singh, K.B. Khanchandani, “Power Electronics”, Tata McGraw – Hill.

**Evaluation Scheme:**

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

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| --- | --- | --- |
| **Chapters** | **Hours** | **Marks Distribution\*** |
| 1 | 9 | 16 |
| 2 | 8 | 14 |
| 3 | 11 | 20 |
| 4 | 9 | 16 |
| 5 | 8 | 14 |
| **Total** | **45** | **80** |

\*There could be a minor deviation in Marks distribution