

Course Title: Power Electronics

Course Code: EPEG 318

Credit Hours: 3

Course Description:

The course extends the treatment covered in earlier courses in electronics towards power and industrial electronics.

Course Contents:

Unit 1: Introduction

Recent advancement in power electronics and its application; Power semiconductor switching devices; Power diodes, Power transistors, Power MOSFET, IGBT, MCT, and their characteristics; Freewheeling diodes, Diodes with RC and RL, LC and RLC loads

Unit 2: Thyristor

Principle of operation, Construction, Two transistor analogy, Gate characteristics, Ratings, turn on/off mechanism, Protection and cooling, Firing circuits, Opto-isolators and pulse transformers, Trigger devices (UJT, PUT, DIAC, UJT/PUT relaxation oscillator), Series and parallel operation of thyristors, Triacs and GTOs)

Unit 3: Static Switches

Single phase and three phase AC switches, Three-phase reversing switches, AC switches for bus transfer, DC switches, Solid state relays, and design of static switches.

Unit 4: Thyristor Converters

Single and three-phase rectification, Half- and full- controlled rectifiers, power factor improvement, Introduction to twelve pulse converters, Rectifiers with inductive load, AC voltage controllers and cyclo-converters; Harmonic analysis and their remedial methods, application in single phase and 3-phase converter fed drives

Unit 5: Inverters

Principles and types, Adjustment of AC frequency and voltage, PWM-inverter; Commutation; Inverter operation with inverse power flow, VSI and CSI, grid following and grid forming inverter

Unit 6: Choppers

Introduction and classification, Step down and step up chopper, Force commutation, two-quadrant chopper, Circuit configuration and switching sequence, chopper fed drives and braking

Unit 7: HVDC Power Transmission

HVDC station configuration, Advantage of HVDC over HVAC, Mono-bi-homo polar dc links, Reactive Var requirements of HVDC converters, Equivalent circuit of HVDC transmission line

Unit 8: Miscellaneous Applications and Problems

Some special applications: SMPS, UPS, static VAR compensation, Thyristor applications in non-conventional energy sources, Electronic load controller.

References:

1. M.H. Rashid, *Power Electronics Circuits, Devices and Applications*, PHI
2. J. Vithayathil, *Power electronics - Principles and Applications*, Mc Graw Hill
3. R.S. Ramshaw, *Power Electronics: Thyristor Controlled Power for Electric Motors*, Springer
4. P.S. Bhimbra, *Power Electronics*, Khanna Publishers
5. C. A. Schuler & W. L. McNamee, *Industrial Electronics*, McGraw Hill
6. F. D. Petruzella, *Industrial Electronics*, McGraw Hill
7. C.W. Lander, *Power Electronics*, 3rd Ed, McGraw-Hill 1993
8. W.P. Robbins, T.M. Undeland, N. Mohan, *Power Electronics: Converters, Applications and Design*, John Wiley 1989
9. P. C. Sen, *Power Electronics*, Tata Mc Graw Hill

Evaluation:

In-Semester Evaluation: 50%

End-Semester Evaluation: 50%