Approval: 13th Senate Meeting

IIT Mandi
Proposal for a New Course

Course Number	: EE527
Course Name	: Analysis and Design of Power Electronic Converters
Credits	: 3-0-0-3
Prerequisites	: EE 309 - Power Electronics or Equivalent or Instructor Consent
Intended for	: BTech Final year/M.Tech./MS/PhD
Distribution	: Core course for M.Tech. Power Electronics and Drives (PED), Elective for final year Electrical Engineering, MS, PhD
Semester	: Odd/Even

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1. Preamble:

This is an advanced course in the field of power electronics. Power electronics is an enabling technology that covers wide spectrum of applications including power supplies for all electronic equipment ranging from cell phones to mainframe computers, interface of renewable energy resources and mobility applications. This course will provide design oriented analysis of topologies and control methods for various advanced power electronic converters used in recent applications. This course is also helpful for students interested in doing projects in this field. It is recommended that the students opting for this course should have the basic knowledge of power electronics.

2. Course Modules with quantitative lecture hours:

- **Introduction** **(2 hours)**
  - Review of basic power electronics concepts, power control through switching; overview of power devices, converters and emerging applications
- **AC-DC Converters** **(11 hours)**
  - Introduction types of AC-DC converters such as line commutated type, Multipulse topologies, and PWM rectifiers
  - Power quality issues related to AC-DC converters, Mitigation through AC-DC power factor correction circuits in single phase and three phase application and through multi-level AC-DC conversion
  - Modelling, design and control of power factor correction circuits
  - Bi-directional PWM rectifiers: Dynamic switching function models, control and applications as front end converters
- **DC-AC converters** **(12 hours)**
  - Introduction to DC-AC converters including multilevel, inverters for open ended load configurations and their switching strategies
  - Voltage source and current source converters - topologies and PWM techniques
  - Single phase and three phase inverters: Dynamic models, control methods and applications as grid connected converter

- Applications in low frequency AC synthesis and three-phase PWM techniques
- Calculation of switching and conduction losses in DC-AC converters

- **AC-AC Converters** **(10 hours)**
  - Introduction to AC-AC converters including matrix converters and multi-stage converters
  - Single phase and three phase matrix converters - topologies and PWM techniques
  - Modelling and control strategies of matrix converters
  - Multi-stage converters: Voltage link & current link topologies, dynamic models, Control methods and applications
- **High frequency link Converters** **(7 hours)**
  - Introduction to high frequency link converters including resonant inverters and high frequency rectifiers
  - Basic concepts on inverters with resonant DC link, high–frequency rectifiers, and dc–dc resonant converters and their applications in energy storage system

3. Textbooks

1. Mohan N., Undeland T.M. and Robbins W.P., "Power Electronics –Converters, Applications and Design", 3rd Ed., Wiley India. 2008
2. Power Electronics: Essentials & Applications, by L. Umanand, Wiley India (2009)

4. Reference books

1. R.W. Erickson, D. Maksimovic, "Fundamentals of Power Electronics" Kluwer Academic Publishers, second edition.
2. Bin Wu,"High-Power Converters and AC Drives", IEEE Press, A John Wiley & Sons, Inc Publication, New York, 2006.
3. Rashid M., "Power Electronics- Circuits, Devices and Applications", 3rd Ed., Pearson Education.
4. A. I.Pressman,"Switch Mode Power Supply Design", McGraw-Hill, 1999, New York.
5. R.S. Ramshaw,"Power Electronics Semiconductor Switches", Champman & Hall, 1993.
6. D. Grahame Holmes, Thomas A. Lipo "Pulse width modulation for power converters: principles and practice", A John Wiley & Sons, INC, 1st Ed., 2003.

5. Similarity Content declaration with existing courses: About 5-10% with EE309

6. Justification of new course proposal if cumulative similarity content is >30%: NA