



**E6221 Jan 3:1**

## **Switched Mode Power Conversion**

### **Instructor**

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### **Teaching Assistant**

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**Department: Electrical Engineering**

Course Time: MWF 9.00-10.00am

Lecture venue: EE-B308

Detailed Course Page: <http://www.ee.iisc.ac.in/new/people/faculty/vjohn/course.html>

### **Announcements**

This course is intended as the second course on power electronics.

### **Brief description of the course**

The course is intended for anyone who would like to specialize in the power electronic conversion area.

### **Prerequisites**

There are no formal prerequisites. However, the course assumes that the student is comfortable with the material covered in E6-201.

### **Syllabus**

Switched mode power supplies (SMPS):

- 1) Non-isolated dc-dc converter: buck, boost, buck-boost, Cuk, sepic; continuous conduction mode and discontinuous conduction mode analysis; non-idealities in the SMPS
- 2) Modeling and control of SMPS, duty cycle and current model control, canonical model of the converter
- 3) Audio-susceptibility, output impedance analysis, extra-element theorem, input filter design
- 4) Isolated dc-dc converters: flyback, forward, push-pull, half bridge and full bridge topologies; transformer design for high frequency isolation
- 5) High frequency output stage in SMPS: voltage doubler and current doubler output rectifiers

6) Power semiconductor devices for SMPS: static and switching characteristics, power loss evaluation, turn-on and turn-off snubber design

7) Resonant SMPS: load resonant converters, quasi resonant converters and resonant transition converters.

Laboratory component with hands on exercises on:

1) Opamp circuits for current and voltage sensing in converters.

2) Differential amplifiers for sensing in presence of common mode voltages

3) Higher order filters, phase shifters, reference and pulse width modulator comparator circuits

4) Efficiency modeling and prediction in dc-dc converters

5) Dynamic response and compensator design for dc-dc converters

### **Course outcomes**

The student is expected with both the design and control of dc-dc converters at the end of the course. The laboratory exercises are designed to make the student comfortable with the auxiliary circuits associated with the power electronics converters and also with basic dc-dc converters.

### **Grading policy**

1) 2 Tests each with 20 points = 40 points

2) 7 homeworks including two lab assignments = 10 points

3) Finals = 50 points

All tests and exams are open note book.

### **Assignments**

About 7 assignments including lab assignments.

### **Resources**

Weblinks:

Prof. V.Ramanarayanan book on power electronics is available at:

<http://www.ee.iisc.ac.in/new/people/faculty/vjohn/ref/smpcbook,%20VR.pdf>

Prof. V.Ramanarayanan and Prof. L.Umanand's course on Switched mode power conversion is available at:  
<http://nptel.ac.in/courses/108108036/>

References:

1. Robert Ericson, Fundamentals of Power Electronics, Chapman & Hall, 2004.
2. V. Ramanarayanan, Switched Mode Power Conversion, 2007.
3. Umanand.L, Power Electronics: Essentials and Applications, Wiley India, 2009.
4. B. Jayant Baliga, Power Semiconductor Devices; PWS 1996.