

INSTITUTE	FACULTY OF TECHNOLOGY
PROGRAM	MASTER OF TECHNOLOGY in ELECTRICAL ENGINEERING
SEMESTER	1
COURSE TITLE	SWITCHING POWER SUPPLIES
COURSE CODE	01EV1105
COURSE CREDITS	4

Objective:

- 1 The student is expected with both the design and control of dc-dc converters at the end of the course.

Course Outcomes: After completion of this course, student will be able to:

- 1 Analyse an equivalent circuit model of switched mode power supply for steady-state analysis.
- 2 Design of magnetic components (i.e., inductor and transformer) for converters used in power supply
- 3 Compare the operation of resonance switching power converters with traditional converters
- 4 Develop feedback controller to regulate DC output of power supply and obtain its frequency response
- 5 Analyse the performance of SMPS with various input filters

Pre-requisite of course: Basic Power electronics devices and its working. Different applications of power semiconductor devices. Power electronics circuit operations.

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Introduction to Non-isolated dc-dc converter: Buck Converter, Boost Converter, Buck-Boost Converter, Cuk Converter, SEPIC converters., Non-idealities in the SMPS	6
2	Isolated dc-dc converters: Flyback Converter,, Forward Converter, , Push-Pull Converter,, Half bridge Converter , Full bridge Converter topologies.	7

Contents : Unit	Topics	Contact Hours
3	Resonant Converters: Classification of Resonant Converters, Basic Resonant Circuit Concepts, Load-Resonant Converters,, Resonant-Switch Converters, Zero-Voltage-Switching, Clamped-Voltage Topologies, , Resonant-dc-Link Inverters with Zero-Voltage Switchings,, High-Frequency-Link Integral-Half-Cycle Converters.	6
4	Reactive Elements in Power Electronic Systems: Introduction, Electromagnetics, , Design of Inductor, , Design of Transformer,, Capacitors for Power Electronic Application, Types of Capacitors	8
5	Modelling and control of SMPS: Introduction, Duty cycle and current model control, canonical model of the converter, , Averaged Model of the Converter, Generalized State Space Model of the Converter, Dynamic Model of Converters Operating in DCM.	8
6	Control of Switched Mode Converters (SMPS): Introduction, Closed Loop Control, , Closed Loop Performance Functions, , Effect of Input Filter on the Converter Performance, , Design Criteria for Selection of Input Filter.	8
Total Hours		43

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Experiment No. 01 To verify the performance of Non-isolated DC-DC buck converter.	2
2	Experiment No. 02 To verify the performance of Non-isolated DC-DC boost converter.	2
3	Experiment No. 03 To design and verify the OpAmp based current sensor for DC-DC converter.	2
4	Experiment No. 04 To verify the performance of Isolated Flyback converter.	2
5	Experiment No. 05 To verify the performance of Isolated Forward converter.	2
6	Experiment No. 06 To verify the performance of Isolated Push-Pull converter.	2
7	Experiment No. 07 To predict efficiency of Boost converter using equivalent model of converter.	2
8	Experiment No. 08 To Simulate the performance of ZVS Resonant converter.	2
9	Experiment No. 09 To simulate the closed loop control of DC-DC converter.	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
10	Experiment No. 10 Demonstrate the use of dSPACE 1104 to generate PWM signal.	2
Total Hours		20

Textbook :

- 1 Switched Mode Power Supplies in Practice, Otmar Kilgenstein , John Wiley and Sons., 2003

References:

- 1 Power Electronics Essentials and Applications, Power Electronics Essentials and Applications, L. Umanand, Wiley India Ltd., 2009
- 2 Switched Mode Power Conversion, Switched Mode Power Conversion, V. Ramanarayanan, NPTEL, 2007
- 3 Switching Power supply Design, Switching Power supply Design, Abraham Pressman, McGraw Hill, 1998
- 4 Power Electronics – Converters, Applications and Design, Power Electronics – Converters, Applications and Design, Ned Mohan, Tore M. Undeland and William P. Robbins, John Wiley & sons, Inc., 3rd ed., 2003
- 5 Switch mode power supply handbook – 1st edition, Switch mode power supply handbook – 1st edition, Keith H Billings, Mc-Graw hill Publishing Company., 1989
- 6 Switching power supplies A to Z. – 1st edition, Switching power supplies A to Z. – 1st edition, Sanjaya Maniktala , Elsevier Inc., 2006
- 7 DC-DC Switching Regulator Analysis, DC-DC Switching Regulator Analysis, Daniel M Mitchell, McGraw Hill Publishing Company, 1988

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
5.00	10.00	15.00	35.00	25.00	20.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and classroom.

Instructional Method:

- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Supplementary Resources:

- 1 <https://nptel.ac.in/content/storage2/courses/108103009/download/M4.pdf>
- 2 [https://nptel.ac.in/content/storage2/courses/108105066/PDF/L-8\(SSG\)\(PE\)%20%20\(\(EE\)NPTEL\).pdf](https://nptel.ac.in/content/storage2/courses/108105066/PDF/L-8(SSG)(PE)%20%20((EE)NPTEL).pdf)
- 3 <https://nptel.ac.in/courses/108/108/108108036/>