

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B.Tech. (Electrical Engineering)
Semester:	V
Course Code:	3EE302ME24
Course Title:	Electronic Power Supply Design
Course Type:	Department Elective-I
Year of Introduction:	2024 – 25

L	T	Practical component				C
		LPW	PW	W	S	
3	0	2	-	-	-	4

Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. performance analysis and design of linear power supplies (BL4)
2. evaluate the performance parameters of switching devices based power supply (BL5)
3. design magnetics, gate circuits and protection circuits for power supply applications (BL5)
4. propose and select appropriate control strategy and design controller for switching devices based power supply (BL6)

Contents:

Teaching Hours: 45

Unit-I	Linear Power Supply Design	08
	Introduction to linear voltage regulator, operating principle, shunt linear voltage regulator, series linear voltage regulator, low drop out voltage regulator, op-amp based linear power supply design, short circuit protection, foldback protection, design examples	
Unit-II	Switched Mode Power Supply	09
	Switched mode power conversion – overview, power semiconductor switches, reactive components, non-isolated converters, isolated converters, operation and analysis of converters in CCM and DCM	
Unit-III	Control of Switched Mode Power Supply	08
	State space representation, average model of converter, small signal model of converter, transfer function of converter, circuit averaged model of converter, generalized state space model, controller basics, dc-dc converter controller, controller structure, PID controller, implementation of PID controller, current mode control, voltage mode control	
Unit-IV	Magnetics Design	08
	Magnetic concepts, flux and flux density, volt-second balance, ferrite core losses and frequency relation, inductor value and energy storage, area product, window area, cross sectional area, design of inductors, multiple winding inductors, transformer design, planar magnetics, input filter design	
Unit-V	Soft Switching Converters	07
	Introduction, resonant load converter, resonant switch converter, zero voltage switching, zero current switching, ZCS and ZVS based buck and boost converter	

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

This shall consist of at least 05 practical / simulations based on the above Contents.

Suggested Reading:

1. M. Rashid, Power Electronics Circuits and Applications, Pearson Education.
2. L. Umanand, Power Electronics Essentials and Applications, Wiley India Pvt. Ltd.
3. Abraham Pressman, Switching Power Supply Design, McGraw Hill professional.
4. David A. Bell, Operational Amplifiers and Linear ICs, Oxford University Press.
5. Clayton R. Paul, Introduction to Electromagnetic Compatibility, John Wiley
6. H. W. Ott, Noise reduction techniques in electronic systems, John Wiley & Sons
7. L. Corradini, D. Maksimovic, P. Mattavelli and R. Zane, Digital Control of High-frequency Switched-Mode Power Converters, IEEE press and Wiley, USA
8. C. W. T. McLyman, Transformer and Inductor Design Handbook, Marcel Dekker.
9. and S.R. Bhat, Design of magnetic components for switched mode power Converters, Wiley Eastern Ltd
10. V. Ramnarayan, Course Material on Switched Mode Power Conversion

**Suggested List of Experiments (not restricted to the following):
(Only for Information)**

Title of Experiment	Hrs.
1. Design and development of linear power supply	6
2. Design, fabrication and testing of magnetic components for dc-dc converter	4
3. Design, fabrication, and testing of gate driver circuit for switched mode power converter	6
4. Designing a controller for dc-dc converter	4
5. Design, fabrication, and testing of a switched mode power converter	6
6. Design of soft switching converter	4

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. academic year 2024 - 25 and onwards