NIRMA UNIVERSITY
Institute of Technology
B. Tech. in Electrical Engineering
Semester – V

L	T	P	C
3	0	0	3

Course Code	**2EEDE01**
Course Title	**Electrical Power Supply Design**

Course Outcomes (COs):

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

1. analyze practical design aspects of component used in power electronic converter
2. apply the basic concepts of modelling for power supply converters
3. select appropriate topology of converter for electrical power supply
4. investigate the EMI/EMC problems in electrical power supply

Syllabus **Teaching Hours: 45**

Unit-1: Linear Power Supply Design **03**

Types of power supplies, characteristics of linear power supply, series and shunt pass power supplies, IC based linear power supplies, applications of linear power supply

Unit-2: Switched Power Supplies **05**

Switched mode power conversion – overview, power semiconductor switches, reactive components, non-isolated converters, isolated converters, CCM and DCM operation of converters, multiple output SMPS, concept of resonant converter

Unit-3: Modelling of Converters **13**

State space representation, circuit averaging, state space model of boost converter, controller basics, dc-dc converter controller, controller structure, PID controller, implementation of PID controller, controller design principles, common practical control applications, controllers and sensing circuit, regulation of multiple outputs, current control, unity power factor converter

Unit-4: Magnetics Design for SMPS **07**

Introduction, core materials and geometries and peak flux density selection, ferrite core losses versus frequency and flux density for widely used core materials, ferrite core geometries, peak flux density selection, maximum core output power, core and bobbin areas, area product approach for designing inductor, choke and transformer, planar magnetics

Unit-5: Design of UPS System **13**

Type of UPS, Topologies of UPS, form factor, UPS rating, Major UPS components, Transformer less UPS systems, Battery charger design, Selection of battery bank, factors affecting the battery life. Ah capacity, Back – up time, Redundancy, Applications, applicable standards

Unit-6: **Electromagnetic Interference (EMI) in Electronic Systems** **07**

Terminology, EMI issues in power circuits, conducted noise emission from SMPS, conducted noise emission standards, EMI issues in PWM techniques, ground loops problem in power converters, radiated emission issues in power converters, power distribution issues in PCB using different converters, conducted noise emission standards

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.

A visit to relevant industry, manufacturing sites, demonstration of EMI measurements through videos and / or related lab visits be encouraged.

Suggested Readings:

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. C. W. T. McLyman, Magnetic Core Selection for Transformers and Inductor, Marcel Dekker.
10. L. Umanand and S.R. Bhat, Design of magnetic components for switched mode power Converters, Wiley Eastern Ltd

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

w.e.f. academic year 2020-21 and onwards