NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**B.Tech. (Electrical Engineering)**
Semester:	**VI**
Course Code:	**3EE312CC26**
Course Title:	**Electronics System Design**
Course Type:	**Core**
Year of Introduction:	**2025 – 26**

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Course Learning Outcomes (CLOs):

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

1. select design parameters of electronic circuits (BL4)
2. implement gate driver and protection circuits (BL5)
3. design an electronic circuit for an application (BL6)
4. analyse the effect of PWM control on electronic circuit performance. (BL4)

Unit	Contents	Teaching Hours (Total 45)
Unit-I	**Power Supply Design** IC-based linear power supplies, SMPS IC's, magnetic component requirement and design, filter design, voltage regulation, load regulation, EMI/EMC considerations	**12**
Unit-II	**Design of Power Electronic Converter** Power circuit design, requirement of gate drive, IC-based gate driver circuits, snubber circuits design, protection circuit needs and heat sink design, selection of ratings of components and power devices, signal sensing and its conditioning	**12**
Unit-III	**Controller Design** 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, controller structure, PID controller, implementation of PID controller	**10**
Unit-IV	**Understanding PCBs** Single-layer and multi-layer PCBs, holes, vias, layers limitations, board setup: layers, dimensions, grid, units, component placement strategy, routing techniques, design rules and constraints	**04**

Unit-V **Implementation of PWM Control** **07**

Initializing timers and internal ADC of microcontroller, scaling ADC signals, programming and signal generation using a microcontroller, generation of fixed and variable PWM, hardware interfacing and testing

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

Suggested Readings/ References:

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

Suggested List of Experiments: Laboratory work will be based on the above syllabus with a minimum 08 experiments to be incorporated. The students in a suitable group size will design and perform one experiment as a part of laboratory work.

Sr. No.	Name of Experiment	Hours
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 power converter	4
4.	Designing a controller for dc-dc converter	4
5.	Design, fabrication, and testing of a power converter	4
6.	Sensor, ADC and DAC interface with micro controller	4
7.	Generation of Fixed PWM for power electronic converter	4
8.	Design and fabrication of PCB	4