

## NIRMA UNIVERSITY

<b>Institute:</b>	<b>Institute of Technology</b>
<b>Name of Programme:</b>	<b>M. Tech. in Electrical Engineering (Electric Vehicular Technology)</b>
<b>Semester:</b>	<b>II</b>
<b>Course Code:</b>	<b>6EE161</b>
<b>Course Title:</b>	<b>Electronic System Design</b>
<b>Course Type:</b>	( <input type="checkbox"/> Core/ <input type="checkbox"/> Value Added Course / <input checked="" type="checkbox"/> <b>Department Elective</b> / <input type="checkbox"/> Institute Elective/ <input type="checkbox"/> University Elective/ <input type="checkbox"/> Open Elective / <input type="checkbox"/> Any other )
<b>Year of Introduction:</b>	<b>2022 – 23</b>

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		LPW	PW	W	S	
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### Course Learning Outcomes (CLOs):

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

1. understand practical design aspects and fabricate power electronic converters of chargers **(BL6)**
2. design and fabricate inverters of motors used for electric vehicles **(BL6)**
3. design thermal and protection circuits **(BL6)**
4. investigate the various output waveforms with necessary troubleshooting **(BL5)**

### Syllabus:

**Teaching Hours: 30**

#### Unit-1: Design of Converters for chargers:

**12**

Converter design – buck, boost and buck-boost, forward, Fly back, Push – pull, Bridge, LLC resonant, Magnetic component requirement and design, Filter design, EMI/EMC considerations, Design of closed loop control.

#### Unit-2: Design of Inverter:

**12**

Design of driver circuit with isolation and protection for single phase half – bridge inverter, full-bridge inverter, and three-phase inverter, SRM inverters, filter design, Selection of ratings of components and power devices, Signal sensing and its conditioning, PWM circuit design for single – phase and three – phase inverter.

#### Unit-3: Thermal and Protection circuit design :

**06**

Thermal calculations, heat sink design, protection needs, types of protection, protection circuit design, 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.

### Laboratory Work:

Laboratory work will be based on above syllabus with minimum 08 experiments to be incorporated.

**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. National/International Standards.

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

**(Only for Information)(04 to 06 hours each)**

1. Design and fabrication of magnetic components for converters.
2. Design, fabrication, and testing of dead-band circuit for inverter.
3. Design, fabrication, and testing of gate driver circuit.
4. Designing of heat sink for converters
5. Design, fabrication and testing of protection circuits for converters.
6. Design, fabrication, and testing of non-isolated switched mode power converter.
7. Design, fabrication, and testing of isolated switched mode power converter.
8. Design, fabrication, and testing of IC based sinusoidal PWM scheme for an inverter.
9. Demonstration of controller based PWM generation.
10. Signal sensing using ADC and visualization on DAC of controller.
11. Generation of variable duty cycle for closed loop control using controller.

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

w.e.f. academic year 2022 - 23 and onwards