Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NEED507	Wireless Power Transfer	3	0	0	3

Course Objective

- This course explains the fundamental principles and latest advances in wireless power transfer (WPT) and illustrates key applications of this emergent technology. This also imparts knowledge about various mitigation of WPT problem and compensation for inductor power transfer. Demand for safe power transfer and durable operation are the main objective of the course. However, strong fundamental knowledge about power electronic components and their interfacing are the prerequisite for the course.

Learning Outcomes

Upon successful completion of this course, students will develop:

- an understanding of the fundamental principles of WPT for cable-free transfer of power
- an acquaintance with theories for inductive power transfer (IPT) based on the coupled inductor model and low-order circuit compensation
- a thoughtful design and control techniques for specific converter topologies in lighting and battery charging applications

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	**Introduction:** Basic topologies with transformers. Input, output and transfer characteristics of power converters. Incorporation of leaky transformer. Control methods.	5L	Knowledge about the with transformers leaky transformers
2	**Basic Circuit Theory:** Review of transformers. Leakage inductance. Circuit compensation principles. Low-order compensations; series and parallel compensations. Resonance and operating frequency. Efficiency equation.	7L	Information about the transformers. Leakage Inductance. Circuit compensation principles. Low-order compensations
3	**Power Converters Fundamentals:** Power Converters Fundamentals DC-DC converters. AC-DC converters and inverters. PWM and soft switching principles.	7L	Knowledge about the Power Converters Fundamentals
4	**Compensation Configurations:** Types of compensation for inductor power transfer. Characteristics for various termination requirements. Design for load-independence output voltage and output current. Efficiency optimization.	7L	The method of handling compensation for inductor power transfer.
5	**Applications:** Circuit requirements for various loading conditions. Characteristics of LED loads, resistors and battery loads. Appropriate compensation design. Lighting systems. Battery charging profiles. Electric vehicle charging. Energy efficiency metric for charging.	8L	Appropriate compensation in design. Lighting systems. Battery charging profiles. Electric vehicle charging.
6	**Technology Trends:** Demand for safe power transfer and durable operation. Portable and smart devices. Mobile communication devices. IoT devices and systems. Sensors. Solid state lighting development. Battery technologies. Electric vehicle development. Renewable source integration trends. Future trends and demand for wireless power transfer.	8L	After the successful completion, student will get idea of demand for safe power transfer and durable operation.
	Total Contact Hours	**42L**	

Text Books:

1. C. T. Rim and C. Mi, "Wireless Power Transfer for Electric Vehicles and Mobile Devices", New York: IEEE Press-Wiley, 2017.
2. J. I. Agbinya, "Wireless Power Transfer", River Publishers, 2015.

Reference Books:

1. Philip T. Krein, "Elements of Power Electronics", Oxford University Press, USA, ISBN-10: 0195117018
2. Z. Huang, S. C. Wong, and C. K. Tse, "Design of a single-stage inductive power-transfer converter for efficient EV battery charging," IEEE Transactions on Vehicular Technology, vol. 66, no. 7, pp. 5808-5821, July 2017.
3. L. Xu, Q. Chen, X. Ren, S. C. Wong, and C. K. Tse, "Self-oscillating resonant converter with contactless power transfer and integrated current sensing transformer," IEEE Transactions on Power Electronics, vol. 32, no. 6, pp. 4839-4851, June 2017.