**Course Description**

Principles of power electronics. This course is designed to give the students in electrical engineering a practical introduction to electrical power distribution and transmission. Topics dealing with electric power distribution engineering such as distribution system planning, load characteristics, application of distribution transformers, distribution substations and transmission lines, primary and secondary systems, voltage drop and power-loss calculations, application of capacitors, voltage regulation, and distribution system protection and reliability.

**Learning** **Outcomes**

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| **Course Learning Outcome** |
| 1. Understand basic operation of various power semiconductor devices and passive components. |
| 1. Understand the basic principle of switching circuits. |
| 1. Analyze and design an AC/DC rectifier circuit. |
| 1. Analyze and design DC/DC converter circuits. |
| 1. Analyze DC/AC inverter circuit. |
| 1. Analyze and design AC/AC converter circuits. |
| 1. Understand the role power electronics play in the improvement of energy usage efficiency and the development of renewable energy technologies. |
| 1. Work successfully in teams. |
| 1. Develop professional lab and project reports. |

**Weekly Outline**

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| **Topic** |
| Introduction to power electronics, elementary switching circuit, power Semiconductor devices, device loss calculation. |
| Operating mechanism of power devices including diodes, BJTs, MOSFETs, IGBTs, SCRs and GTOs, advantage/disadvantages and applications. |
| Power and harmonics concepts, power factor, Fourier analysis, harmonic distortion, Passive components. |
| Uncontrolled rectifiers including single phase half-wave, full-wave rectifiers, three phase rectifier |
| Controlled rectifiers, half-wave, full-wave and three-phase controlled rectifiers. |
| Non-isolated DC-DC converters, buck (single-ended chopper) converter, boost, buck-boost and buck converters, switching loss and efficiency estimation. |
| Isolated switch mode power supply, forward converter, fly-back converter, half-bridge. |
| DC-AC inversion, pulse-width-modulation (PWM) techniques, harmonic reduction, three-phase inverter. |
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