# Associate Degree Program

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|---|---|
| **Specialty** | **Common** |
| **Course Number** | **020301131** |
| **Course Title** | **Power Electronics** |
| **Credit Hours** | **2** |
| **Theoretical Hours** | **2** |
| **Practical Hours** | **0** |

**Brief Course Description:**

Principles and Methods of Electric Power Conversion. Complementary Components and Systems. AC-to-DC Converters. AC-to-AC Converters. DC-to-DC Converters. DC-to-AC Converters. Switching Power Supplies. Power Semiconductor Devices. List of Principal Symbols. Semiconductor Power Switches. Diodes and Phase-Controlled Converters .Cycloconverters. Voltage-Fed Converters. Current-Fed Converters. Choppers. Basic calculations. Waveforms. Applications

**Course Objectives:**

Upon the completion of the course, the student will be able to:

1. Distinguish power electronics devices.
2. Identify power electronics devices
3. Use power electronics devices.
4. Investigate characteristics of power electronics devices.
5. Test and troubleshoot power electronics devices.
6. Provide basic calculations of power electronics devices.
7. Use energy converters with different loads

**Detailed Course Description:**

| Unit. number | Unite name | Unite content | Time Needed |
|---|---|---|---|
| **1.** | **Power Semiconductor Devices** | ▪ Diodes. Thyristors. Triacs. Gate Turn-Off Thyristors (GTOs). Bipolar Power or Junction Transistors (BPTs or BJTs). Power MOSFETs. Static Induction Transistors (SITs). Insulated Gate Bipolar Transistors (IGBTs). MOS-Controlled Thyristors (MCTs). Integrated Gate-Commutated Thyristors (IGCTs). Power Integrated Circuits (PICs) | |
| **2.** | **Diodes and Phase-Controlled Converters** | ▪ Diode Rectifiers. Thyristor Converters. Converter Control | |
| **3.** | **Frequency Changers** | ▪ Classification and applications. Block diagrams and principle of operation. Examples: Phase-Controlled Cycloconverters. Matrix Converters. High-Frequency Cycloconverters | |
| **4.** | **Voltage-Fed Converters** | ▪ Single-Phase Inverters. Three-Phase Bridge Inverters. Multi-Stepped Inverters. Pulse Width Modulation Techniques. Three-Level Inverters. Hard Switching Effects. Resonant Inverters. Soft-Switched Inverters. PWM Rectifiers | |
| **5.** | **Current-Fed Converters** | ▪ General Operation of a Six-Step Thyristor Inverter. Load-Commutated Inverters. Force-Commutated Inverters. Multi-Stepped Inverters. Inverters with Self-Commutated Devices. Current-Fed vs Voltage-Fed Converters | |
| **6.** | **Choppers** | ▪ Classification, principle of operation, applications | |

**Text Books & References:**

**Textbook:**

1. M. Rashid, Power Electronics Circuits, Devices and Applications, Upper Saddle River, NJ: Pearson Education, 3d Edition, 2003.

**References :**

1. Reddy, Rama S., Fundamentals of Power Electronics, Boca Raton, Fla., CRC Press, 2000.
2. S.B. Dewan and A. Straugher, Power Semiconductor Circuits, John Wiley & Sons, USA, 1994

# Associate Degree Program

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|---|---|
| **Specialty** | **Common** |
| **Course Number** | **020301132** |
| **Course Title** | **Power Electronics Lab** |
| **Credit Hours** | **1** |
| **Theoretical Hours** | **0** |
| **Practical Hours** | **3** |

**Brief Course Description:**

- Test of semiconductor devices. Investigation of characteristics of power electronics devices. Investigation of rectifier, chopper, and inverter circuits under different loads (R, L-loads)

**Course Objectives:**

Upon the completion of the course, the student will be able to:

1. Distinguish power electronics devices.
2. Use power electronics devices.
3. Troubleshoot power electronics devices.
4. Control Thyristors and power transistors.
5. Connect the power electronics circuits.
6. Troubleshoot power electronics converters.
7. Provide basic calculations related to the output of power electronics converters

**Detailed Course Description:**

| Unite number | Lab name | Lab content | Time Needed |
|---|---|---|---|
| **1.** | **Identification and troubleshooting of power electronics semiconductor devices** | | (1 week) |
| **2.** | **Investigation of characteristics of power electronics devices (Diodes, transistors, Thyristors)** | | (2 week) |
| **3.** | **Investigation of firing circuit of Thyristor. (Firing circuit with AC voltage, firing circuit with DC voltage and firing circuit with pulse signals)** | | (2 weeks) |
| **4.** | **Investigation of controlled rectifiers characteristics (Single phase and three phase circuits)** | | (3 weeks) |
| **5.** | **Investigation of Chopping circuits** | | (1 week) |
| **6.** | **Investigation of inverter characteristics. (Single phase and three phase circuits)** | | (3 weeks) |
| **7.** | **Investigation of frequency changers characteristics** | | (2 weeks) |

**Evaluation Strategies:**

| Exams | | Percentage | Date |
|---|---|---|---|
| Exams | First Exam | 20% | --/--/---- |
| | Second Exam | 20% | --/--/---- |
| | Final Exam | 50% | --/--/---- |
| Homework and Projects | | 10% | |
| Discussions and lecture Presentations | | | |

**Teaching Methodology:**

- Lab. work

**Text Books & References:**

**References :**

Instructional Lab. Sheets