**University of Management and Technology**

**Course Outline**

Course code……EE 446………………… Course title……Power Electronics……………………

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| Program | BSEE,BS(H) |
| Credit Hours | 3 |
| Duration | One semester |
| Prerequisites | Electronic Devices and Circuit EE-208 |
| Resource Person | 1.Arif Saeed (Sec A,B)  2.Fahad Usman(Sec C,D) |
| Counseling Timing  (Room# ) | See Office Door and EE Website |
| Contact | [arif.saeed@umt.edu.pk](mailto:arif.saeed@umt.edu.pk)  fahad.khan@umt.edu.pk |

**Chairman/Director signature………………………………….**

**Dean’s signature…………………………… Date………………………………………….**

**Learning Objective:**

Upon completion of this course, students will:

(a) Develop and quantify common performance objectives for power electronic circuits.

(b) Develop simple power electronic converter topologies to meet certain functional specifications.

(c) Analyze power electronic converter operation to develop design guidelines for choice of switching devices and reactive elements.

(d) The course strongly supports expected **outcomes** a, b, d, e, g, h and i of the

HEC Electrical Engineering Curriculum.

**Learning Methodology:**

Lecture, interactive, participative

**Grade Evaluation Criteria**

Following is the criteria for the distribution of marks to evaluate final grade in a semester.

**Marks Evaluation Marks in percentage**

Quizzes & Assignments 25

Mid Term 25

Final exam 50

Total 100

**Recommended Text Books:**

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**Text book:** Muhammad H. Rashid, *“Power Electronics Circuits, Devices, and Applications”*,

3rd edition

**Reference Books:**

1) Mohan, Undeland, Robbins *“Power Electronics Converters, Applications and*

*Design”*, 3rd edition

2) C. W. Lander, "Power Electronics", McGraw Hill, Latest Edition

**Calendar of Course contents to be covered during semester**

**Course code……………………………...... Course title………………………………………**

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| --- | --- | --- |
| **Week** | **Course Contents** | **Reference Chapter(s)** |
| 1 | Introduction: Power Semiconductor Devices, Control characteristics and Specifications of Power devices, Types of Power Electronic Circuits. | Ch-1 |
| 2 | Power Semiconductor Diodes and Circuits: Diode Characteristics, Reverse Recovery Characteristics, Diodes with RC and RL Loads, Diodes with LC and RLC Loads, Freewheeling Diodes. Recovery of Trapped Energy with a Diode | Ch-2 |
| 3 | Diode Rectifiers: Single –Phase Half-Wave Rectifiers, Single –Phase Full-Wave Rectifiers, Single –Phase Full-Wave Rectifiers with RL Load, Three –Phase Bridge Rectifiers, Three –Phase Bridge Rectifiers with RL load, | Ch-3 |
| 4 | Power Transistors: Bipolar Junction Transistors, Power MOSFETs, COOLMOS, SITs, IGBTs, di/dt and dv/dt Limitations, Comparison of Transistors. | Ch-4 |
| 5,6 | DC-DC Converter: Principle of Step-Down Operation, Step-Down Converters with RL Load, Principle of Step-Up Operation, Step-UP Converters with Resistive Load, Performance Parameters, Converter Classification, Switching Mode Regulators (Buck, Boost, Buck-Boost) | Ch-5 |
| 7 | Pulse –Width Modulated Inverters: Principle of Operation, Performance Parameters, Single-Phase Bridge Inverters. | Ch-6 |
| 8 | **Mid Term Examination** |  |
| 9 | Pulse –Width Modulated Inverters: Three-Phase Inverters, Voltage Controlled Single- Phase Inverters, Voltage Controlled Three- Phase Inverters. | Ch-6 |

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| 10,11 | Thyristors: Characteristics, Two-Transistor Model, Thyristor Turn-On-Off, Thyristor Types ( BCTs, LASCRs, GTOs, IGCTs, SITH etc), di/dt protection, dv/dt protection. | Ch-7 |
| 12 | Resonant Pulse Inverters: Series Resonant Inverter, Frequency Response of Series Resonant Inverter, Parallel Resonant Inverter, Voltage Control of Resonant Inverter | Ch-7 |
| 13,14 | Controlled Rectifiers: Single-Phase Full Converter, Single-Phase Dual Converter, Three-Phase Full Converter | Ch-7 |
| 15 | Power Supplies: DC Power Supplies (Forward converters, Flyback converters), AC Power Supplies (Switching Mode Power Supplies) | Ch-8 |