**University of Management and Technology**

School of Engineering

Department of Electrical Engineering

**Course Outline**

Course code……EL-446…... Course Title………Power Electronics Lab………

|  |  |
| --- | --- |
| Program | BSEE |
| Credit Hours | 1 |
| Duration | One semester |
| Prerequisites | EE111: Circuits Analysis  EE209: Electronic Devices and Circuits |
| Resource Person | Nauman Ahmad1(Section C1)  Farah Sarwar2 (Section A2)  Salman Khalid3 (Sections A1, B1, B2, D1) |
| Counseling Timing  Room# | See Office doors for timing.  C1-16, Machines Lab1,2  Digital Systems Lab, Level , SEN3 |
| Contact | [nauman.ahmad@umt.edu.pk](mailto:nauman.ahmad@umt.edu.pk)1  [farah.sarwar@umt.edu.pk](mailto:farah.sarwar@umt.edu.pk)2  [salman.khalid@umt.edu.pk](mailto:salman.khalid@umt.edu.pk)3 |

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

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

**Learning Objective:**

This course provides an introduction to power electronics and its applications. The course starts with coverage of modern power semiconductor devices, their characteristic, and drive circuit design. Topologies of power electronic circuits including single phase and three phase ac-dc rectifiers, dc-dc converters, and dc-ac inverters will be covered along with their control techniques. Applications of modern power electronic devices are also included with emphasis on switch mode and linear regulators. These objectives confirm to the ones’ listed in HEC guidelines as a, d, e, & f.

In accordance with HEC curriculum outcomes a, d, & k, students at the end of the course should be able to:

* Develop and quantify common performance objectives for power electronic circuits.
* Develop simple power electronic converter topologies to meet certain functional specifications.
* Analyze power electronic converter operation to develop design guidelines for choice of switching devices and reactive elements.

**Learning Methodology:**

Practical, 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**

Lab Manuals & Performance: 40%

Final Viva or Quiz + Performance: 60%

Total: 100%

**Recommended 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**

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|  |  |  |
| --- | --- | --- |
| **Week** | **Experiment Name** | **Relevance to Theory Course** |
|  | Single phase half wave uncontrolled rectifier with R, RL load | Half wave Rectifier Operation with resistive and inductive load, wave form distortion due to energy storage phenomenon , Form Factor , Ripple Facto, Rectifier Efficiency , Crest Factor , Free wheeling diode significance ,etc. |
|  | Single phase full wave uncontrolled rectifier with R,RL load | Full wave Rectifier Operation with resistive and inductive load, wave form distortion due to energy storage phenomenon , Form Factor , Ripple Facto, Rectifier Efficiency, Free wheeling diode significance etc |
|  | A simple series voltage regulator | Understanding of Series topology of regulator, Line and load regulation, effect of line and load variations on conduction level of BJT |
|  | A simple shunt voltage regulator | Understanding of Shunt topology of regulator, Line and load regulation, effect of line and load variations on conduction level of BJT |
|  | An improved variable output series voltage regulator | Understanding of Improved topology of regulator, Line and load regulation, effect of line and load variations on conduction level of BJT |
|  | A variable voltage regulator using op-amp with over current protection | Understanding of OP-AMP topology of regulator, Line and load regulation, effect of line and load variations on conduction level of BJT |
|  | VI Characteristics of Thyristor | SCR forward and reverse characteristics,forward blocking region, forward conduction region, reverse blocking region, latching and holding current, forward break over voltage, etc |
|  | **Mid Exam** | |
|  | SCR using R firing circuit | Firing and conduction angle variations and their effect on output voltage, current and Power for half and full wave rectifiers |
|  | SCR using RC firing circuit | Firing and conduction angle variations with increased range and their effect on output voltage and Power for half and full wave rectifiers |
|  | Single phase half wave controlled rectifier with R,RL load | Single phase Controlled Half wave rectifier operation with R and RL load |
|  | Single phase full wave controlled rectifier with R,RL load | Single phase Controlled Full wave rectifier operation with R and RL load |
|  | Design and simulation of Buck regulator and Boost regulator | Buck and Boost operation, designing of critical values of capacitors and inductors, duty cycle effect, switching topology understanding |
|  | Design and simulation of Buck-Boost regulator | Buck and Boost operation(combined), designing of critical values of capacitors and inductors, duty cycle effect, switching topology understanding |
|  | Simulink Models | Lecture Notes  MATLAB/Simulink Help |
|  | **Final Exam** | |