

SYLLABUS: POWER ELECTRONICS

Date / Revision August 22, 2017 / 22.08.17 /MaS
Faculty Engineering
Study Programm Mechatronics

SUBJECT: Power Electronics

1 Basic Information

1.01	Subject Name	Power Electronics
1.02	Semester	5
1.03	Level	1
1.04	SKS	3
1.05	Mandatory / Curriculum	Mandatory / D-11
1.06	Subject Code	ECEP
1.07	Subject Code	MTE-D-ECEP-5111
1.08	Year	2017 (7)
1.09	Quality Control	Final Test, see evaluation
1.10	Limitations	Min 12 and Max 32 students in one class
1.11	Combined with	ELE
1.12	Perquisite	Electronics Devices and Circuits 1,2
1.13	Responsible	Dean of Engineering Faculty
1.14	Revision	22-08-2017/MaS

2 Description of Subject

This course will provide the participants with the knowledge covering backgrounds, scopes and approaches in modern power semiconductor devices as switching devices eg. Diode, SCR, TRIAC, GTO, BJT, MOSFET, IGBT-Static and Dynamic characteristics - Triggering and commutation circuit for SCR- Design of Driver and Snubber circuit. The Static and switching characteristics, gate drive and protection techniques will be discussed. Various DC-DC, AC-DC, DC-AC and AC-AC converter circuit topologies, their characteristics and control techniques. The goal of this course is to provide a solid basic understanding of power semiconductor devices, switching power converters, conversion topology and application of power electronics such as drive system for variable speed drives, rectifier and FACTS devices. The theory will be complemented by computer simulations using PSPICE or PSCAD.

3 Objectives

- Introduces the concept of Power Electronics
- introduce the different type of converter and inverter and their characteristics
- design, and analysis of an inverter

4 Competency

- After having the course, students are expected have to:
- Describe the different types of power semiconductor devices and their switching characteristics.
 - Describe the operation, characteristics and performance parameters of controlled rectifiers
 - Explain the operation, switching techniques and basics topologies of DC-DC switching regulators.
 - Describe the modulation techniques of pulse width modulated inverters and to explain the harmonic reduction methods.
 - Explain the operation of AC voltage controller and various configurations

5 Learning Approach / Methodology

- Lectures/ Class contact (time-tabled) supplemented with interactive questions and answers;
- Discussion, simulating the circuits, laboratory experiments, sample problem, group work;
- Student Study Effort: homework/assignment; preparation for test/quizzes/ examination.

6 Evaluation

5.1	Absence maximum	25%
5.2	Participation in Discussion	05 Points
5.3	Homework / Classwork	05 Points
5.4	Presentation /Simulation	10 Poin
5.5	Daily Quiz	20 Points
5.6	Final Examination	60 Points
	Total	100 Points

7 Text Book and Reference

- 1 **Main Text Book:**
Mohan Ned, Tore. M. Undel and, William. P. Robbins, ' Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition,2003, ISBN: 978-0-471-22693-2

2	Supplementary Text books: <ul style="list-style-type: none"> • Leybold Power Electronics and Drives Lab-Manual
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8	Content / Topics of Lecture
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Week	Content/ Topics of Lecturing	Text Book	Remark
1	Introduction <ul style="list-style-type: none"> • What is Power Electronics? • Switching Device • Application of Power Electronics • Basic Converter Topology 	Ch-01	
2	Power semiconductor devices <ul style="list-style-type: none"> • Diode and Thyristor • BJT • MOSFET • IGBT 	Ch-02	
3	Review of Basic Electrical System <ul style="list-style-type: none"> • Phasor • RLC circuits • Three phase electrical system • Magnetic Circuits 	Ch-03 Supplement	
4	Diode Rectifiers (Half wave and Full wave) <ul style="list-style-type: none"> • Basic Concept of rectification • Single phase rectifier • Three phase rectifier • Resistive load, Inductive and capacitive load • Comparison of Single-Phase and Three-Phase Rectifiers 	Ch-05	Quiz-1
5	Line-Frequency Phase-Controlled Rectifiers and Inverters: Line-Frequency ac Controlled dc. <ul style="list-style-type: none"> • Thyristor circuit and their control • Single phase converter • Three phase converter • Other Three-Phase Converters 	Ch-06	
6	DC – DC Switch Mode Converter <ul style="list-style-type: none"> • Control of dc-dc Converters • Basic of DC-DC Converter • Buck Converter • Boost Converter • Buck-Boost Converter • C_{uk}-dc Converter 	Ch-07	Quiz-2
7	Full bridge DC-DC converter <ul style="list-style-type: none"> • Full bridge DC-DC converter control • Dc-dc converter comparison 	Ch-07	
8	MIDTERM SEMESTER BREAK		

9	Worklab & Computer Simulation <ul style="list-style-type: none"> • Leybold Power Electronics Module • Introduction to PSCAD/PSPICE 	Extra Workbook	
10	DC Drives <ul style="list-style-type: none"> • Basic topology of dc drives • Application of DC- Drives control 		Quiz-3
11	Inverters <ul style="list-style-type: none"> • Basic concept of inverter • Voltage source inverter and current source inverter 	Ch-08	
12	PWM inverter <ul style="list-style-type: none"> • Introduction • PWM techniques 		Quiz-4
13	Resonant Converters: Zero-Voltage and/or Zero-Current Switching <ul style="list-style-type: none"> • Classification of Resonant Converter • Basic Resonant Circuit Concepts • series resonant converter • parallel resonant converter 	Ch-09	
14	AC-Motor Drives and Practical Converter <ul style="list-style-type: none"> • Leybold Power Electronics Module 	Extra Workbook	
15	AC-Motor Drives and Practical Converter Design Consideration <ul style="list-style-type: none"> • Snubber circuit • Gate drive circuit • Protection circuit 	Ch-12	Quiz-5
16	Final Examination		