

EE302 POWER ELECTRONICS

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Course Objectives: This course aims to equip the students with a basic understanding of modern power semiconductor devices, various important topologies of power converter circuits for specific types of applications. The course also equips students with an ability to understand and analyze non-linear circuits involving power electronic converters.

Prerequisites: Electron devices, Circuit theory, Electrical machines.

Power Semiconductor Devices –power diodes, power transistors, SCRs, TRIAC, GTO, power MOSFETs, IGBTs-Principles of operation, characteristics, ratings, protection and gate drive circuits.

Controlled rectifiers- single- phase and three-phase- power factor improvement (qualitative treatment)-dual converters.

DC-DC converters- Buck, Boost, Buck-Boost types with circuit configuration and analysis.

DC-AC converters-1-phase/3- phase, VSI, CSI, frequency and voltage control.

AC-AC converters- single/three phase controllers, phase control, PWM AC voltage controller, Principle of ON-OFF control and cyclo-converters. Introduction to Matrix converters

Text Books:

1. Rashid, M.H, 'Power Electronics - Circuits, Devices and Applications', Prentice Hall Publications, 3rd Edition, 2003.
2. M.D.Singh and K.B.Khanchandani, 'Power Electronics', Tata McGraw Hills Publishing Company Limited, 2nd Edition, 2006.
3. Ned Mohan, Tore M. Undeland, William P. Robbins, 'Power Electronics', John Wiley & Sons Publications, 3rd edition, 2006.

Reference Books:

1. Vedam Subramaniam, 'Power Electronics', New Age International (P) Ltd Publishers, 2001.
2. Philip T. Krein, 'Elements of Power Electronics', Oxford University Press, 1st Edition, 2012.
3. V.R.Moorthi, 'Power Electronics- Devices, Circuits and Industrial Applications', Oxford University Press, 1st Edition, 2005.

COURSE OUTCOMES:

Upon completion of the course

1. The student will be able to understand the principle of operation of commonly employed power electronic converters.
2. The student will be capable of analyzing non-linear circuits with several power electronic switches.
3. The student will be equipped to take up advanced courses in Power Electronics and its application areas.

EE304 POWER SYSTEM PROTECTION AND SWITCHGEAR

L	T	P	C
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Course Objectives: To give a broad coverage on all types of protective relays, circuit breakers and provide a strong background for working in a practical power system protection system.

Prerequisites: Fundamentals in power system analysis and short circuit studies

Relays – General classification, Principle of operation, types, characteristics, Torque equation, Relaying Schemes, Relay Co- ordination.

Apparatus and line protection – Line Protection – Distance, Differential protection and Carrier current protection. Generator protection – protection against abnormal condition, stator and Rotor protection. Transformer Protection – Incipient fault – Differential protection, Feeder and Bus bar protection.

Protection against over voltages – Causes of over voltage Ground wires, Surge absorbers and diverters. Earthling - types. Insulation coordination.

Theory of arcing and arc quenching circuit breakers types – rating and comparison, RRRV, Resistor switching and capacitor switching.

Static relays – Digital relays - Microprocessor based relays – Apparatus and line protection – Basics of Numerical relays.

Text Books:

1. *Badri Ram and Vishwakarma, D.N., 'Power System Protection and Switchgear', Tata- McGraw Hill publishing company Ltd., 2nd Edition, 2011.*
2. *Ravindranath B., and Chander, N., 'Power Systems Protection and Switch Gear', Wiley Eastern Ltd., 1st Edition, 1977.*

Reference Books:

1. *Sunil S.Rao, 'Protective Switch Gear', Khanna Publishers, New Delhi, 13th Edition, 2008.*
2. *Y. G. Paithangar, 'Fundamentals of power system protection', PHI Learning Private Limited, 2nd Edition, 2010.*

COURSE OUTCOMES:

Upon completion of the course the students would be able to

1. Classify and describe the working of various relaying schemes
2. Identify and implement an appropriate relaying schemes for different power apparatus
3. Illustrate the function of various CBs and related switching issues
4. Describe the causes of overvoltage and protection against overvoltage

EE306 MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	C
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Course Objectives: To gain knowledge on the architecture of 8085 microprocessors and 8051 micro controller, their programming and associated peripheral interface devices.

Prerequisites: Digital Electronics, Electron Devices and Linear Integrated Circuits

8-Bit Microprocessor - 8085 architecture and memory interfacing (RAM & ROM), interfacing I/O devices - instruction set - addressing modes - assembly language programming – interrupts - timing diagram.

8051 Microcontroller - Intel 8051 architecture, memory organization, flags, stack, and special function registers, I/O, ports - connecting external memory, counters and timers, serial data I/O, Interrupts.

Microcontroller instructions - addressing modes, moving data, logical operations, arithmetic operations, jump and call instructions – subroutines - Interrupts and returns.

Microcontroller programming - Assembly Language Programming, timer and counter programming, connection to RS 232 and RS 485, Interrupt programming.

Peripherals and interfacing - Serial and parallel I/O (8251 and 8255), Programmable DMA controller, Programmable interrupt controller, ADC/DAC interfacing.

Case Study:(i)Waveform generation (ii)speed control of DC motor(iii)Stepper motor control (iv)seven segment LED display (v)Firing Pulse generation (vi) Traffic Control Systems etc.

Text Books:

1. Ramesh S. Gaonkar, 'Microprocessor Architecture Programming and Applications with 8085', Penram Intl. Publishing, 6th Edition, 2013.
2. Kenneth Ayala, 'The 8051 Microcontroller', Cengage Learning Publications, 3^d Edition, 2007.
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay 'The 8051 Microcontroller and Embedded Systems using Assembly and C', Prentice Hall Publications, 2nd Edition, 2008.

Reference Books:

1. Ray A. K., Bhurchandi K. M., 'Advanced Microprocessor and Peripherals', Tata McGraw-Hill Publications, 3rd Edition, 2013.
2. Sencer Yeralan, Helen Emery, 'Programming and interfacing the 8051 Microcontroller', Addison-Wesley Publications, 1st Edition, 2000.
3. Krishna Kant, 'Microprocessors and Microcontrollers, Architecture, Programming and System Design-8085, 8086, 8051, 8096', Prentice Hall India Ltd Publications, 1st Edition, 2010

COURSE OUTCOMES:

Upon completion of this course, the students will

1. Have a clear understanding of the architecture and instruction set of 8085 and 8051.
2. Be able to interface peripherals and memories with 8085 and 8051
3. Be able to understand the application of 8085 and 8051 in waveform generators.

EE308 VLSI DESIGN

L	T	P	C
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Course Objectives: To enrich the student with the concepts of VLSI devices and its fabrication and also to develop different electronic circuits.

Prerequisites: Essentials of Electronic devices, circuits and Digital systems.

MOS characteristics: NMOS characteristics, inverter action – CMOS characteristics, inverter action - models and second order effects of MOS transistors – Current equation – MOSFET Capacitances - MOS as Switch, Diode/ resistor – current source and sink – Current mirror.

CMOS Fabrication – n-well, p-well, twin-tub processes – fabrication steps – crystal growth – photolithography – oxidation – diffusion – Ion implantation – etching – metallization.

CMOS Logic Circuits: Implementation of logic circuits using nMOS and CMOS, Pass transistor and transmission gates – Implementation of combinational circuits – parity generator – magnitude comparator – stick diagram – layout design.

Memory design – SRAM cell – 6T SRAM – DRAM – 1T, 3T, 4T cells CMOS Sequential circuits: Static and Dynamic circuits – True single phase clocked registers – Clocking schemes.

ASIC - Types of ASICs - Design flow – Design Entry – Simulation – Synthesis – Floor planning – Placement – Routing - Circuit extraction – Programmable ASICs.

Text Books:

1. Neil Weste, David Harris, 'CMOS VLSI Design: A Circuits and Systems Perspective', Addison-Wesley, 4th Edition, 2010.
2. Debaprasad Das, 'VLSI Design', Oxford University press, 2010.
3. Ken Martin, 'Digital Integrated Circuits', Oxford university press, 1999.

Reference Books:

1. M. J. S. Smith, 'Application Specific Integrated Circuits', Addison Wesley, 1997.
2. Uyemura, 'Introduction to VLSI Circuits and Systems', Wiley, 1st Edition, 2012

COURSE OUTCOMES:

Upon completion of this course , students will be able to

1. To understand the insights of the MOS devices and its characteristics.
2. To appreciate the different VLSI process technologies.
3. To design the CMOS combinational logic circuits and its layout
4. To develop the sequential circuits and clocking schemes
5. To realize the Design flow of Application specific Integrated circuit

EE310 POWER ELECTRONICS LABORATORY

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Course Objectives: To enable the students to develop hands on experience in analyzing, designing and carrying out experiments on various electrical networks by make use of power electronic components. It aims to familiarize the switching devices, power converters and its applications in various systems for power control.

Prerequisites: Circuits and Devices Laboratory.

List of Experiments

1. 1-phase Fully Controlled SCR Converter
2. Buck Converter using MOSFET
3. Boost Converter using MOSFET
4. Buck-Boost Converter using IGBT
5. 1-phase Inverter using IGBT.
6. 1-phase step-down Cyclo-converter
7. Speed Control of 1-phase A.C Motor
8. 1-phase Half Controlled SCR Converter
9. Illumination Control of Lamp
10. Speed Control of 1-phase Capacitor Run Fan Motor
11. Characteristics of SCR, IGBT, MOSFET

Mini project

COURSE OUTCOMES:

Upon completion of the course, the students will be able to

1. Understand the characteristics of various switching devices and appreciate its applications in various electrical networks/systems.
2. Analyze and design the operation of power switching converters.
3. Develop practical control circuits for various real time applications.
4. Analyze and prepare the technical report on the experiments carried out.

**EE312 MICRO-COMPUTING AND VLSI DESIGN
LABORATORY**

L	T	P	C
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Course Objectives: To train the students to use micro-processor, micro-controller and FPGA for computational and logical applications. Also this course prepares the students to provide solutions to real-time problems.

Prerequisites: Basics of Digital logics and programming skills

List of Experiments

1. Arithmetic operations (8/ 16 bit) using 8085.
2. Waveform generation using 8085.
3. Interfacing with 8085 (ADC, DAC)
4. Arithmetic operations (16 bit) using 8051
5. Firing pulse generation using 8051.
6. Interfacing with 8051 (Stepper motor/ DC Motor control).
7. VHDL programming for PWM pulse generation
8. Design and Simulation of Sequence detector circuit using Verilog HDL.
9. Design and FPGA implementation of 4-bit multiplier unit.
10. Layout and physical design of a Mod-N counter unit.

Mini – Project

COURSE OUTCOMES:

Upon completion of the course, the students will be able to

1. Accomplish arithmetic and logical operations with micro-processors, micro-controllers and FPGA
2. Generate firing pulses for various control applications related to electrical machines and power electronics.
3. Illustrate various interfacing techniques related to real time applications, using micro-processors and micro-controllers.
4. Analyze and document the experiments carried out.
5. Design and implement control circuitry using micro-processors and micro-controllers for any engineering and real world problems