PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018

(AUTONOMOUS)

M.E. POWER ELECTRONICS AND DRIVES

REGULATIONS 2016

(CHOICE BASED CREDIT SYSTEM)

CURRICULUM

SEMESTER III

Course Code	Course Title	L	T	P	C
PP*1645*	Elective IV	3	0	0	3
PPE1655*	Elective V	3	0	0	3
PPE1665*	Elective VI	3	0	0	3
PPE16301	Project Work (Phase I)	0	0	12	6

SEMESTER IV

Course Code	Course Title	L	T	P	C
PPE16401	Project Work (Phase II)	0	0	24	12

LIST OF ELECTIVES

ELECTIVES IV

Course Code	Course Title	L	T	P	C
PPE16451	Power Electronics in Wind and Solar Power Conversion	3	0	0	3
PPS16452	Distributed Generation and Micro grid	3	0	0	3
PPE16453	Battery Management Systems	3	0	0	3

ELECTIVES V

Course Code	Course Title	L	T	P	C
PPE16551	Special Electrical Machines and Controllers	3	0	0	3
PPE16552	Modern Rectifiers and Resonant Converters	3	0	0	3
PPE16553	Industrial control Electronics	3	0	0	3

ELECTIVES VI

Course Code	Course Title	L	T	P	C
PPE16651	Data Communication and Networks	3	0	0	3
PPE16652	VLSI Design Techniques	3	0	0	3
PPE16653	Virtual Instrumentation Systems	3	0	0	3

ELECTIVE IV

PPE16451 POWER ELECTRONICS IN WIND AND SOLAR POWER CONVERSION **3 0 0 3**

COURSE OBJECTIVES

- To infer knowledge on renewable energy resources.
- To analyze the concepts of wind energy and its application.
- To study characteristics of solar and photovoltaic cell.
- To infer knowledge on overview of power electronics converters.
- To discuss the fundamental concepts of grid connectors in wind and solar.

UNIT I INTRODUCTION **9**

Environmental aspects of electric energy conversion: Renewable energy resources and their importance - Qualitative study of Solar PV, wind electrical systems-control strategy, operating area, operating principles and characteristics. Trends in energy consumption - World energy scenario – Energy sources and their availability - Conventional and renewable sources - Need to develop new energy technologies.

UNIT II WIND ENERGY **9**

Introduction – Basic principles of wind energy conversion system– Nature of wind – site selection consideration – basic components of wind energy conversion system – Types of wind machines – Basic components of wind electric conversion systems. Schemes for electric generations – Generator control, load control, energy storage – applications of wind energy – Inter connected systems- power electronics in Wind Energy Utilization.

UNIT III SOLAR ENERGY **9**

Solar radiation, availability, measurement and estimation, Solar thermal conversion devices and storage, solar cells, solar cell interconnection, solar cell characteristics and photovoltaic conversion – PV systems – analysis of PV systems- MPPT - Applications of PV Systems – solar energy collectors and storages-power electronics in solar Energy Utilization-DC-DC converters for solar PV systems.

UNIT IV POWER CONVERTERS **9**

Solar: Block diagram of solar photo voltaic system : line commutated converters (inversionmode) - Boost and buck-boost converters- selection Of inverter, battery sizing, array sizing. Wind: three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT V GRID CONNECTED WIND & SOLAR ENERGY CONVERSION SYSTEMS **9**

Grid connectors – Connection issues- Wind farm and its accessories – Grid related problems – Generator control – Performance improvements - Different schemes –Power converters for Grid connected Wind Energy Conversion System and Grid connected Solar Energy Converter systems, Hybrid Systems, Types of Cogeneration processes.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- understand renewable energy resources and their importance.
- describe about the basic components in wind energy system.
- understand the characteristics of solar cell and photovoltaic system.
- explain the modern power converters for renewable energy power harness.
- evaluate grid connection issues,performance improvements of wind and solar.

REFERENCES

1. Mukund R. Patel, "Wind and Solar Power Systems: Design, Analysis, and Operation, Second Edition", CRC Taylor & Francis, 2006.
2. J.A. Duffie and W.A. Beckman, "Solar Engineering of Thermal Processes", Second Edition, John Wiley, New York, 1991.
3. D.Y. Goswami, F. Kreith and J.F. Kreider, "Principles of Solar Engineering", Taylor and Francis, Second Edition, 1999.
4. D. D. Hall and R.P. Grover, "Bio-Mass Regenerable Energy, John Wiley, Newyork, 1987.
5. Haitham Abu-Rub, Mariusz Malinowski, Kamal Al-Haddad, "Power Electronics for Renewable Energy Systems, Transportation and Industrial Applications", Wiley Publications, 2014.
6. Ewald F. Fuchs, Mohammad A.S. Masoum," Power Conversion of Renewable Energy Systems ", Springer, 2012.

WEB LINKS

1. https://www.youtube.com/watch?v=mpHZWYpKDJg
2. https://www.youtube.com/watch?v=gMxPkVQYXz8
3. https://www.youtube.com/watch?v=IPxRujJ4_oY

PPS16452 DISTRIBUTED GENERATION AND MICROGRID 3 0 0 3

COURSE OBJECTIVES

- To understand Conventional power generation
- To analyze interconnecting distributed resources to electric power systems.
- To point out the impact of grid integration with NCE sources on existing power system.
- To study concept and definitions of Micro grid and its configuration.
- To produce knowledge on various power quality issues in micro grids.

UNIT I INTRODUCTION 9

Conventional power generation: Advantages and disadvantages, Energy crises, Non-Conventional Energy (NCE) resources: Review of Solar PV, Wind Energy systems, Fuel Cells, Micro-turbines, Biomass, and Tidal sources.

UNIT II DISTRIBUTED GENERATIONS (DG) 9

Concept of distributed generations, topologies, selection of sources, regulatory standards/ framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547.DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels. Captive power plants.

UNIT III GRID INTEGRATION IN DG 9

Requirements for grid interconnection, limits on operational parameters: Voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.

UNIT IV MICROGRIDS 9

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids, communication infrastructure, modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes.

UNIT V POWER QUALITY ISSUES IN MICROGRIDS 9

Power quality issues in micro grids- Modeling and Stability analysis of Microgrid, regulatory standards, Microgrid economics, Introduction to smart micro grids.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- upon completion of the course, students will be able to
- understand the basic concept of distributed generation.
- summarize the interconnecting Distributed resources to electric power systems.
- analyze the impact of grid integration with NCE sources on existing power system.
- study the concepts and definitions of Microgrid and its configuration.
- demonstrate the availability based tariff and framework of Indian power sector.

REFERENCES

1. AmirnaserYezdani, and Reza Iravani, “Voltage Source Converters in Power Systems: Modeling, Control and Applications”, IEEE John Wiley Publications, 2009.
2. DorinNeacsu, “Power Switching Converters: Medium and High Power”, CRC Press, Taylor & Francis, 2006.
3. Chetan Singh Solanki, “Solar Photo Voltaics”, PHI learning Pvt. Ltd., New Delhi, 2009.
4. J.F. Manwell, “Wind Energy Explained, theory design and applications,” J.G. McGowan Wiley publication, 2002.
5. D. D. Hall and R. P. Grover, “Biomass Regenerable Energy”, John Wiley, New York, 1987.
6. John Twidell and Tony Weir, “Renewable Energy Resources” Tyalor and Francis Publications, 2005.

WEB LINKS

1. nptel.ac.in/courses/108108034/
2. www.egr.msu.edu/~mitraj/misc/Mitra_seminar_LANL.pdf
3. https://www.ee.iitb.ac.in/wiki/faculty/sak

PPE16453 BATTERY MANAGEMENT SYSTEM 3 0 0 3

COURSE OBJECTIVES

- To infer knowledge on battery technology.
- To understand battery management system.
- To know various types of batteries and their reactions.
- To acquire the knowledge on energy storage and generation system.
- To overview the applications of batteries.

UNIT I BATTERY TECHNOLOGY OVERVIEW 9

Principle of Operation– Technologies– Review of Rechargeable Batteries– Common Rechargeable Batteries, Comparison and Applications– Charge Algorithms.

UNIT II BATTERY MANAGEMENT SYSTEM 9

Building Units of a Battery Management System: Sensors, Monitoring Unit, Diagnostics Unit, Protection Unit, Control Unit, Communications – Battery Charger Framework: Fundamentals and Description of Building Components– Required Protections.

UNIT III BATTERIES AND REACTIONS 9

Introduction– Voltaic Cells– Battery Cell Types– Battery Performance– Current, Voltage, and standard Reduction Potential– Different Types of Batteries and Some Additional Facts– Hazards– Electron Activity in chemical reactions– Battery Construction– Battery Ratings– Special Purpose Batteries– Practical Considerations– Batteries.

UNIT IV ENERGY STORAGE AND GENERATION 9

Electrochemical Batteries– Types of Batteries, Lead-Acid Batteries, Nickel Based Batteries, Lithium Based Batteries– Electro Chemical Reactions– thermodynamic Voltage, Specific Energy, Specific Power, Energy Efficiency– Ultra Capacitors– DC generator– AC Generator– Voltage and Frequency Regulations.

UNIT V APPLICATIONS OF BATTERIES 9

Stationary applications- Load Leveling, lead-acid batteries for telecommunications and UPS, Lead-acid batteries for solar and wind energy storage- Miscellaneous applications- Tracking Systems, Toll Collection, Oil Drilling, Car Accessories, Oceanography- Battery management and life prediction- Battery collection and recycling- World market for industrial batteries.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- discuss the overall view on Battery management System.
- understand the knowledge on Battery Management System.
- summarize batteries and their reactions.
- define the energy storage and generation.
- familiarize different kinds of applications by using of batteries.

REFERENCES

1. D. Andrea, Battery Management Systems for Large Lithium Battery Pack, Artech House Publishers, 2010.
2. R.W. Erickson, D. Maksimovic, Fundamentals of Power Electronics, 2nd Edition, Kluwer Academic Publishers, 2001.
3. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L "Battery Management Systems -Design by Modelling" Philips Research Book Series 2002.
4. Davide Andrea," Battery Management Systems for Large Lithium-ion Battery Packs" Artech House, 2010.
5. Harwood, William, Herring, Geoffrey, Madura, Jeffry, and Petrucci, Ralph. General Chemistry: Principles and Modern Applications. Ninth Edition. Upper Saddle River, New Jersey: Pearson Prentice Hall, 2007.
6. Kiehne, H.A. Battery Technology Handbook. Second Edition. Renningen-Malsheim, Germany: Expert Verlag, 2003.

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1. http://ethesis.nitrkl.ac.in/2976/1/Thesis.pdf
2. http://mocha-java.uccs.edu/ECE5720/ECE5720-Notes01.pdf
3. http://www.sciencedirect.com/science/article/pii/B9780444521606500036
4. http://en.wikipedia.org/wiki/Battery_(electricity)
5. http://www.youtube.com/watch?v=Pd-RhoTogHA

ELECTIVE V

PPE16551 SPECIAL ELECTRICAL MACHINES AND CONTROLLERS 3 0 0 3

COURSE OBJECTIVES

- To provide knowledge about the features and principles of several of special machines.
- To know the construction and control scheme of the machines.
- To compare and analyze the static and dynamic characteristics of SRM.
- To provide knowledge about the features, characteristic of PMDC motors and its controllers.
- To walk with the various applications on special electrical machines.

UNIT I STEPPING MOTORS 9

Stepping Motors – Types – Constructional features – principle of operation – modes of excitation, torque production – Characteristics – Linear and Non Linear Analysis - Drive systems, Controllers for stepping motor.

UNIT II SYNCHRONOUS RELUCTANCE MOTORS 9

Constructional features of axial and radial air gap Motors – operating principle – reluctance torque – phasor diagram – motor characteristics permanent magnet synchronous motors – Principle of operation – EMF and Torque equations –Phasor diagram – Power controllers – Torque speed characteristics – Self-control, Vector control, Microprocessor based control schemes.

UNIT III SWITCHED RELUCTANCE MOTORS 9

Constructional features-principle of operation-Inductance profile-Torque equation- Types of Power controllers and converter topologies used – Current control schemes – Torque Speed Characteristics – Hysteresis and PWM - Microprocessor based controller and Sensor less Controller.

UNIT IV PERMANENT MAGNET BRUSHLESS DC MOTORS 9

Commutation in DC motors, Difference between mechanical and electronic commutators, Hall sensors, Optical sensors, Multiphase Brushless motor, Square wave permanent magnet brushless motor drives, Torque and Emf equation, Torque-Speed characteristics, Controllers-Magnetic Circuit Analysis- microprocessor based controller.

UNIT V LINEAR MOTORS 9

Linear Induction Motor (LIM) classification – construction – Principle of operation – Concept of current sheet – goodness factor – DC Linear Motor (DCLM) types – circuit equation - DCLM control applications – Linear Synchronous Motor(LSM) – Types - Performance equations – Applications.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- know the construction and operating principles of special electrical machines.
- analyze the performance of special electrical machines.
- analyze the different types of controllers and control techniques.
- familiarize with various applications on special electrical machines.
- demonstrate control strategies for applications using special machines.

REFERENCES

1. B.K. Bose, “Modern Power Electronics & AC drives”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2001.
2. R.Krishnan, “Electric Motor Drives – Modeling, Analysis and Control”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2003.
3. Miller, T.J.E. “Brushless permanent magnet and reluctance motor drives ", Clarendon Press, Oxford,1993.
4. Kenjo, T,“Stepping motors and their microprocessor control ", Clarendon Press, Oxford.1997.
5. Naser A and BoldeaL,”Linear Electric Motors: Theory Design and Practical Applications”, Prentice Hall Inc., New Jersey,2013.

WEB LINKS

1. http://www.avlib.in/ebook/title/Special-Electrical-Machines.html
2. http://www.scribd.com/doc/101099222/A-Guide-to-Electric-Drives-and-DC-Motor-Control#scribd.

PPE16552 MODERN RECTIFIERS AND RESONANT CONVERTERS 3 0 0 3

COURSE OBJECTIVES

- To acquire knowledge of power system harmonics.
- To understand fundamentals of PWM methods for Voltage Source Converters.
- To learn various switching operation in resonant converters.
- To analyze state space model to various converters.
- To walk around the various scheme to control the converter.

UNIT I POWER SYSTEM HARMONICS & LINE COMMUTATED RECTIFIERS 9

Average power-RMS value of a waveform-Power factor-AC line current harmonic standards IEC 1000-IEEE 519- The Single phase full wave rectifier-Continuous Conduction Mode-Discontinuous Conduction Mode-Behavior when C is large- Minimizing THD when C is small-Three phase rectifiers- Continuous Conduction Mode- Discontinuous Conduction Mode-Harmonic trap filters.

UNIT II PULSE WIDTH MODULATED RECTIFIERS 9

Properties of Ideal rectifiers-Realization of non ideal rectifier-Control of current waveform-Average current control-Current programmed Control- Hysteresis control- Nonlinear carrier control-Single phase converter system incorporating ideal rectifiers- Modeling losses and efficiency in CCM high quality rectifiers-Boost rectifier Example - expression for controller duty cycle-expression for DC load current-solution for converter Efficiency η.

UNIT III RESONANT CONVERTERS 9

Review on Parallel and Series Resonant Switches-Soft Switching- Zero Current Switching - Zero Voltage Switching -Classification of Quasi resonant switches-Zero Current Switching of Quasi Resonant Buck converter, Zero Current Switching of Quasi Resonant Boost converter, Zero Voltage Switching of Quasi Resonant Buck converter, Zero Voltage Switching of Quasi Resonant Boost converter: Steady State analysis.

UNIT IV DYNAMIC ANALYSIS OF SWITCHING CONVERTERS 9

Review of linear system analysis-State Space Averaging-Basic State Space Average Model-State Space Averaged model for an ideal Buck Converter, ideal Boost Converter, ideal Buck Boost Converter, for an ideal Cuk Converter.

UNIT V CONTROL OF RESONANT CONVERTERS 9

Pulse Width Modulation-Voltage Mode PWM Scheme-Current Mode PWM Scheme- Design of Controllers: PI Controller, Variable Structure Controller, Optimal Controller for the source current shaping of PWM rectifiers.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- know about the harmonics and line commutated rectifiers.
- understand the concepts and operations of Pulse Width Modulated Rectifier.
- identify the different types of resonant converters.
- understand the analysis of switching converters.
- discriminate the concepts of control methods in resonant converter.

REFERENCES

1. Robert W. Erickson &Dragon Maksimovic" Fundamentals of Power Electronics", Springer science and Business media, 2001.
2. Ned Mohan., Undeland and Robbins, " Power Electronics: Converters, Applications and Design ", John Wiley and Sons (Asia) Pte Ltd, Singapore,2003.
3. Rashid, M.H., "Power Electronics – Circuits, Devices and Applications", Pearson Education Pte. Ltd, New Delhi, 2004.
4. B.K. Bose, "Modern Power Electronics & AC drives", Prentice-Hall of India Pvt. Ltd., New Delhi, 2001.

WEB LINKS

1. http://altor1.narod.ru/Books_Docs/Fundamentals_of_Power_Electronics.pdf
2. http://ecee.colorado.edu/copec/book/slides/Ch19slide.pdf
3. http://www.ti.com/lit/ml/slup085/slup085.pdf

PPE16553 INDUSTRIAL CONTROL ELECTRONICS 3 0 0 3

COURSE OBJECTIVES

- To acquire knowledge on the basic industrial control.
- To study the elements in industrial control systems.
- To impart knowledge on the instrumentation devices.
- To understand the concept of intelligent controllers.
- To analyze the application of servo motor control.

UNIT I INTRODUCTION 9

Review of switching regulators and switched mode power supplies, uninterrupted power supplies – on-line and off-line topologies. Embedded control systems - Industrial motion control-motion control systems and technologies-Industrial production automation: Systems and components-Robotics and automation.

UNIT II SENSORS AND ACTUATORS 9

Sensors and actuators-Industrial optical sensors-Industrial physical sensors-Industrial measurement sensors-Industrial actuators. Transducers and valves-Industrial switches- Industrial transducers-Industrial valves.

UNIT III INDUSTRIAL INTELLIGENT CONTROLLERS 9

Signal conditioners – Instrumentation amplifiers – Isolation circuits – opto-electronic devices and control, electronic circuits for photo-electric switches - output signals for photo electric controls; Application of opto-isolation, interrupter modules and photo sensor; Fibre optics; Bar code equipment.

UNIT IV DYNAMIC ANALYSIS OF SWITCHING CONVERTERS 9

PLC controllers –Components and Architecture –PLC control mechanisms - PLC programming – CNC controllers – CNC control mechanism and its programming -FLC controllers – FLC control modeling and industrial controllers.

UNIT V SERVO AND STEPPER MOTOR 9

Stepper motors- types- operation, control and applications; servo motors – types, operation, control and applications – servo motor controllers – servo amplifiers – linear motor applications – selection of servo motor.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- describe the basic industrial control.
- categorize the elements in industrial control systems.
- realize the knowledge of various devices.
- describe the concept of intelligent controllers.
- understand the application of servo motor control.

REFERENCES

1. M. H. Rashid, “Power Electronics Circuits, Devices and Application”, PHI, 3rd edition, 2004. G. M. Chute and R. D. Chute, “Electronics in Industry”, McGraw Hill Ltd, Tokyo, 1995.
2. F. D. Petruzulla, “Industrial Electronics”, McGraw Hill, Singapore, 1996.

3. Terry Bartelt, “Industrial Automated Systems Instrumentation and Motion Control”, ISBN: 1-4354-8888-1., 2nd Edition, 2002.
4. G. K. Mithal, “Industrial Electronics”, Khanna Publishers, Delhi, 2000.
5. Pengzhang, “Advanced Industrial control technology”, Elsevier Inc., 1st Edition 2010.

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2. https://books.google.co.in/books?isbn=0123820375
3. https://books.google.co.in/books?isbn=8120349903
4. www.tigertek.com/servo-motor-resources/common-servo-motor-applications.html

ELECTIVE VI

PPE16651 DATA COMMUNICATION AND NETWORKS 3 0 0 3

COURSE OBJECTIVES

- To understand the fundamental concepts of computer networking.
- To familiarize the student with the basic taxonomy and terminology of the networking.
- To introduce the student to advanced networking in computer networking.
- To make the student to gain expertise in design and maintenance of individual networks.
- To walk around the various applications of computer networks.

UNIT I COMPUTER NETWORKS 9

Evolution of data networks, Network architecture, ISO Reference model examples of networks, Application of networks, Physical layer, and communication medium characteristics-Topologies.

UNIT II MEDIUM ACCESS SUB LAYER AND DATA LINK LAYER 9

Local area networks, conventional channel allocation methods, pure-ALOHA, SALOHA, Finite population ALOHA, Controlled ALOHA, Reservation ALOHA, Design issues for packet radio networks – IEEE Standard for LAN-Ethernet: CSMA/CD LAN, Token passing ring. Data link layer design issues – Service primitives – Stop and wait Sliding window protocols – Comparison of stop and wait and sliding window protocols.

UNIT III NETWORK AND TRANSPORT LAYERS 9

IP: Internetworking-IPv4 & IPv6-Network layer design issues routing algorithm - Congestion control algorithms internetworking. Transport layer design issues – Connection management – A simple transport protocol on top of X.25-Quality of Services (QoS).

UNIT IV APPLICATION LAYER 9

Name Space – Domain Name Space – Resolution – Remote Logging – File transfer access and management, Electronic mail – Virtual terminals – Domain Name System –WWW and HTTP – Network Management and SNMP - Multimedia.

UNIT V CRYPTOGRAPHY & NETWORK SECURITY 9

Cryptography – Network Security: Message – confidentiality, Integrity, Authentication – Digital Signature – Entity Authentication – Key Management – Security in the internet: IPsec, SSLffLs, PGP, Firewalls.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- independently understand basic computer network technology.
- understand and explain Data Communications System and its components.
- identify the different types of network topologies and protocols.
- enumerate the layers of the OSI model and TCP/IP. Explain the function of each layer.
- identify the different types of network devices and their functions with-in a network.

REFERENCES

1. Andrew S.Tanenbaum, “Computer Networks”, Prentice Hall of India, 2003.
2. Behrouz A. Foruzan, “Data communication and Networking”, Tata McGraw-Hill, 2006.
3. Godbole and Kahate, “Computer Communication Networks”, McGraw Hill, 2003.
4. William Stallings, “Data and Computer Communication”, Pearson Education,2000.

WEB LINKS

1. Http://www.tutorialspoint.com/data_communication_computer_network/data_communication_computer_network_tutorial.pdf
2. http://www.sjbit.edu.in/app/course-material/ece/vii/computer%20communication%c3%82%c2%a0network%20%5b06ec71%5d/ece-vii-computer%20communication%c3%82%c2%a0network%20%5b06ec71%5d-notes.pdf
3. http://iit.qau.edu.pk/books/data%20communications%20and%20networking%20by%20behrouz%20a.forouzan.pdf

PPE16652 VLSI DESIGN TECHNIQUES 3 0 0 3

COURSE OBJECTIVES

- To describe the significance of CMOS technology and fabrication process.
- To understand the importance and architectural features of programmable logic devices.
- To apply the ASIC construction, design algorithms and basic analog VLSI design techniques.
- To explain the concepts of sequential system and floor planning.
- To study the logic synthesis and simulation of digital system using VHDL and Verilog HDL.

UNIT I CMOS DESIGN 9

Overview of digital VLSI design Methodologies- Logic design with CMOS-transmission gate circuits - Pass Transistor - Clocked CMOS-dynamic CMOS circuits, Bi-CMOS circuits- Layout diagram, Stick diagram-IC fabrications – Trends in IC technology.

UNIT II PROGRAMABLE LOGIC DEVICES 12

Programming Techniques-Anti fuse-SRAM-EPROM and EEPROM technology – Re- Programmable Devices Architecture- Function blocks, I/O blocks, Interconnects, Xilinx- XC9500,Cool Runner - XC-4000,XC5200, SPARTAN, Virtex - Altera MAX 7000-Flex 10KStratix.

UNIT III BASIC CONSTRUCTION, PLACEMENT AND ROUTING 6

System partitioning– FPGA partitioning – Partitioning methods – placement physical design flow – global routing – detailed routing – special routing- circuit extraction –DRC.

UNIT IV SEQUENTIAL SYSTEMS AND FLOOR PLANNING 6

Memory cells and Arrays, Clocking disciplines, Design, Power optimization, Design validation and testing.Floorplanning methods, Global Interconnect, Floor Plan Design, Off-chip connections.

UNIT V LOGIC SYNTHESIS AND SIMULATION 12

Overview of digital design with Verilog HDL- hierarchical modeling concepts- modules and port definitions- gate level modeling- data flow modeling- behavioral modeling- task & functions- Verilog and logic synthesis-simulation-Design examples- Ripple carry Adders- Carry Look ahead adders- Multiplier- ALU- Shift Registers, Multiplexer-Comparator- Test Bench.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- understand the basic concepts of CMOS circuits.
- acquire knowledge on architectural features of programmable logic devices.
- understand basic analog VLSI design techniques.
- apply and use the sequential system circuits.
- design and simulate the basic analog and digital circuits using Verilog HDL.

REFERENCES

1. E. Eshranghian, D.A. Pucknell and S. Eshraghian, “Essentials of VLSI circuits and systems”, PHI, 2010.
2. Neil H.E. Weste, David Harris and Ayan Banerjee, “CMOS VLSI Design, A circuits and Systems Perspective”, 2010.
3. W. Wolf, “Modern VLSI Design”, Fourth Edition, Pearson, 2009.
4. S.M. Sze, “VLSI Technology”, McGrawHill,Deluxe Edition, 2010.
5. Douglas Perry, ‘VHDL Programming By Example’, Tata McGraw Hill, 2007.
6. John P.Uyemura “Introduction to VLSI Circuits and Systems”, John Wiley & Sons, Inc., 2002.

WEB LINKS

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2. etidweb.tamu.edu/.../VHDL%20Programming%20By%20Example%20d.
3. www.csit-sun.pub.ro/courses/vlsi/Modern_VLSI_Design.pdf.

PPE16653 VIRTUAL INSTRUMENTATION SYSTEMS 3 0 0 3

COURSE OBJECTIVES

- To infer knowledge on Virtual instrumentation Architecture.
- To analyze the new concepts on Graphical programming.
- To understand the programming structure for various parameters.
- To discuss the data acquisition and instrument control.
- To use the applications of hardware and software specifications.

UNIT I INTRODUCTION 9

General Functional description of a digital instrument - Block diagram and Architecture of a Virtual Instrument - Physical quantities and Analog interfaces - Hardware and Software – User interfaces - Advantages of Virtual instruments over conventional instruments –Data flow techniques - Architecture of a Virtual instrument and its relation to the operating system.

UNIT II INSTRUMENT INTERFACE 9

Interfacing of external instruments to a PC – RS 232, RS 422, RS 485 and USB Standards – IEEE 488 standard – ISO – OSI model for series bus – Introduction to bus protocols – Interface basis: USB, PCMCIA, VXI, SCXI, PXI etc.

UNIT III PROGRAMMING TECHNIQUE 9

FOR loops, WHILE loop, CASE structure, formula node, Sequence structures – Arrays and Clusters - Array operations - Bundle - Bundle/Unbundle by name, graphs and charts - String and file I/O - High level and Low level file I/O's.

UNIT IV DATA ACQUISTION 9

Installing hardware, installing drivers - Configuring the hardware –Introduction to data acquisition on PC, Sampling fundamentals,Input/Output techniques and buses. ADC, DAC, Digital I/O, counters and timers, DMA,Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements.

UNIT V APPLICATIONS 9

Motion Control: General Applications - Feedback devices, Motor Drives – Machine vision – Instrument Connectivity - GPIB, Serial Communication - General, GPIB Hardware & Software specifications –Real –Time Systems, Embedded controller, OPC, HMI, SCADA software – Development of process database management system.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- discuss the knowledge on Virtual instrumentation Architecture.
- apply the new concepts in Graphical programming.
- understand the programming structure for various parameters.
- summarize the data acquisition and instrument control.
- implement the applications of hardware and software specifications

REFERENCES

1. Lisa K. wells & Jeffrey Travis, LabVIEW for everyone, Prentice Hall, New Jersey,1997.
2. Gary Johnson, LabVIEW Graphical Programming, Second edition, McGraw Hill, Newyork, 1997.
3. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement,Instrumentation and Control, Newnes, 2000.
4. N.Mathivanan, PC-based Instrumentation: Concepts and Practice, Eastern Economy Edition, PHILearning private Ltd,2007.

WEB LINKS

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2. https://www.ni.com/getting-started/set-up-hardware/
3. www.ni.com/pdf/manuals/370426n.pdf