

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics Engineering (VLSI Design and Technology), IV-Semester

ES401	Energy & Environmental Engineering	3L-1T-0P	4 Credits
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The objective of this Course is to provide an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternative energy sources and their technology and application.

Module 1: Introduction to Energy Science:

Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment; Overview of energy systems, sources, transformations, efficiency, and storage; Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems; possibilities for energy storage or regeneration (Ex. Pumped storage hydro power projects, superconductor-based energy storages, high efficiency batteries)

Module2: Ecosystems

- Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystem (a.)Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Module 3: Biodiversity and its conservation

- Introduction – Definition: genetic, species and ecosystem diversity; Bio-geographical classification of India; Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; Biodiversity at global, National and local levels; India as a mega-diversity nation; Hot-spots of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Module 4: Environmental Pollution

- Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards; Solid waste Management: Causes, effects and control measures of urban and industrial wastes; Role of an individual in prevention of pollution; Pollution case studies; Disaster management: floods, earthquake, cyclone and landslides.

Module 5: Social Issues and the Environment

- From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its problems and concerns. Case Studies
Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies Wasteland reclamation; Consumerism and waste products; Environment Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness.

Module 6: Field work

- Visit to a local area to document environmental assets- river/forest/grassland/hill/mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

REFERENCE

1. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.
2. Clark R.S., Marine Pollution, Clarendon Press Oxford (TB).
3. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai,
4. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
5. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards', Vol I and II, Enviro Media (R)
6. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press.
7. Schaeffer, John (2007), Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living, Gaia

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ED 402 - Introduction to VLSI Design Flow

Course Contents:

System & Architectural Design: Defining a system specification, performance analysis, cost analysis, identifying various functional blocks/modules; categorizing them in terms of digital, analog, RF and mixed signal blocks.

Functional verification, logic design: Verifying the functionality of blocks, behavioral description, logic minimization, synthesis, verification and testing.

Circuit Optimization and Physical Design: Optimization of synthesized blocks for various performance metric, Introduction to placement and route, Layout Vs Schematic (LVS) verification, Design for Manufacturability.

Tape Out: Post layout simulations, Process Voltage Testing, Process Design Kit, Design Rule Check, GDSII

Fabrication and Packaging: CMOS process flow, dicing, various types of packaging. Overview of Lithography, Radiation Sources, Masks, Photoresist, Components of Photoresist Optical Aligners, Resolution, Depth of Focus, Advanced Lithography: E-beam Lithography, X-ray Lithography, Ion Beam Lithography.

Text /Reference Books:

1. Sneha Saurabh, "Introduction to VLSI Design flow", Cambridge University Press.
2. N. H. E. Weste and C. Harris, "Principles of CMOS VLSI Design: A System Perspective, 3rd Edition, Pearson Education 2007
3. M.Morris Mano and Michel.D.Ciletti, Digital Design with an introduction to HDL, VHDL and Verilog, Sixth edition Pearson education.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the intricacies in VLSI Design flow
2. Understand overall process of VLSI Design flow starting from system level all the way to the transistor level.

Introduction to VLSI Design Flow LAB: Using Tanner/Cadence tool students are expected to design the schematics and layout of basic digital and analog circuits. Students are expected to use LVS tool to understand complete VLSI design flow

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ED 403- Microcontroller and Interfacing

Course Contents:

Functional units of a computer, Von Neumann and Harvard computer architectures, CISC and RISC architectures. Processor Architecture – General internal architecture, Address bus, Data bus, control bus. Register set – status register, accumulator, program counter, stack pointer, general purpose registers. Processor operation – instruction cycle, instruction fetch, instruction decode, instruction execute, timing response, instruction sequencing and execution. Algorithms for binary multiplication and division. Fixed and floating-point number representation.

Introduction to Microprocessor, Microprocessor architecture and its operations, Memory, Input & output devices, Logic devices for interfacing, The 8085 MPU, Example of an 8085 based computer, Memory interfacing. Basic interfacing concepts, interfacing output displays, Interfacing input devices, Memory mapped I/O,

Data Transfer operations, Arithmetic operations, Logic Operations, Branch operation, Addressing modes, Writing assembly language programs, Programming techniques: looping, counting and indexing. Additional data transfer and 16 bit arithmetic instruction, Arithmetic operations related to memory, Logic operation: rotate, compare, counter and time delays. Subroutines. Interrupts.

8255 Programmable peripheral interface, interfacing keyboard and seven segment display, 8254 (8253) programmable interval timer, 8259A programmable interrupt controller, Direct Memory Access and 8237 DMA controller.

Microcontrollers and Embedded Processors. Architecture – Block diagram of 8051, Pin configuration, Registers, Internal Memory, Timers, Port Structures, Interrupts. Assembly Language Programming - Addressing Modes, Instruction set (Detailed study of 8051 instruction set is required).

Simple programming examples in assembly language. Interfacing with 8051 using Assembly language programming: LED, Seven segment LED display. Programming in C – Declaring variables, Simple examples – delay generation, port programming, code conversion. Interfacing of – LCD display, Keyboard, Stepper Motor, DAC and ADC -- with 8051 and its programming. 8051 Timers/Counters - Modes and Applications. Serial Data Transfer – SFRs of serial port, working, Programming the 8051 to transfer data serially.

NPTEL course: <https://nptel.ac.in/courses/106102157>

Text/Reference Books:

1. Computer System Architecture, Mano M M , Prentice Hall India.
2. 8085 Microprocessor Architecture, Applications and Programming, Ramesh S Gaonkar, Penram International.
3. The 8051 microcontroller and Embedded systems, Muhammed Ali Mazidi & Janice Gill Mazidi, Pearson Education.

Course Outcomes:

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

1. Explain the functional units with respect to computer architecture
2. Develop simple programmes using 8085/8051 assembly language
3. Interface 8085 with peripherals using assembly language
4. Interface 8051 with peripherals using assembly language/C

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ED 404- Control Systems

COURSE CONTENTS:

Unit-1 Introduction to Control system: Terminology and classification of control system, examples of control system, mathematical modeling of mechanical and electrical systems, differential equations, transfer function, block diagram representation and reduction, signal flow graph techniques.

Feedback characteristics of control systems Open loop and closed loop systems, effect of feedback on control system and on external disturbances, linearization effect of feedback, regenerative feedback

Unit-2 Time response analysis Standard test signals, time response of 1st order system, time response of 2nd order system, steady-state errors and error constants, effects of additions of poles and zeros to open loop and closed loop system

Time domain stability analysis Concept of stability of linear systems, effects of location of poles on stability, necessary conditions for stability, Routh-Hurwitz stability criteria, relative stability analysis, Root Locus concept, guidelines for sketching Root-Locus

Unit-3 Frequency response analysis Correlation between time and frequency response, Polar plots, Bode Plots, all-pass and minimum-phase systems, log-magnitude versus Phase-Plots,

closed-loop frequency response **Frequency domain stability analysis :** Nyquist stability criterion, assessment of relative stability using Nyquist plot and Bode plot (phase margin, gain margin and stability).

Unit-4 Approaches to system design Design problem, types of compensation techniques, design of phase-lag, phase lead and phase lead-lag compensators in time and frequency domain, proportional, derivative, integral and Composite Controllers.

Unit-5 State space representation of systems, block diagram for state equation, transfer function decomposition, solution of state equation, transfer matrix, relationship between state equation and transfer function, controllability and observability

Text/Reference Books:

1. Albert D. Helfrick, William David Cooper, "Modern electronic instrumentation and measurement techniques", TMH 2008.
2. Oliver Cage, "Electronic Measurements and Instrumentation", TMH, 2009.
3. Alan S. Morris, "Measurement and Instrumentation Principles", Elsevier (Buterworth Heinmann), 2008.
4. David A. Bell, "Electronic Instrumentation and Measurements", 2nd Ed., PHI, New Delhi 2008.
5. H.S. Kalsi, "Electronics Instrumentation", TMH Ed. 2004
6. A.K.Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai.
7. MMS Anand, "Electronic Instruments & Instrumentation Technology", PHI Pvt. Ltd., New Delhi Ed. 2005

CONTROL SYSTEM LAB

Control System performance analysis and applications of MATLAB in Control system performance analysis & design

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ED 405- Analog Circuits

COURSE CONTENTS:

Feedback Amplifier and Oscillators: Concept of feedback and their types, Amplifier with negative feedback and its advantages. Feedback Topologies.

Oscillators: Concept of Positive feedback, Classification of Oscillators, Barkhausen criterion, Types of oscillators: RC oscillator, RC Phase Shift, Wien Bridge Oscillators. LC Oscillator: Hartley, Colpitt's, Clapp and Crystal oscillator.

Introduction to integrated circuits: Advantages and characteristic parameters of IC's, basic building components, data sheets

Operational Amplifier: Differential amplifier and analysis, Configurations- Dual input balanced output differential amplifier, Dual input Unbalanced output differential amplifier, Single input balanced output differential amplifier, Single input Unbalanced output differential amplifier Introduction of op-amp, Block diagram, characteristics and equivalent circuits of an ideal opamp, Power supply configurations for OP-AMP.

Characteristics of op-amp: Ideal and Practical, Input offset voltage, offset current, Input bias current, Output offset voltage, thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio (CMRR), Slew rate and its Effect, PSRR and gain bandwidth product, frequency limitations and compensations, transient response, analysis of TL082 datasheet.

OP-AMP applications: Inverting and non-inverting amplifier configurations, Summing amplifier, Integrators and differentiators, Instrumentation amplifier, Differential input and differential output amplifier, Voltage-series feedback amplifier, Voltage-shunt feedback amplifier, Log/ Antilog amplifier, Triangular/rectangular wave generator, phase-shift oscillators, Wein bridge oscillator, analog multiplier-MPY634, VCO, Comparator, Zero Crossing Detector. OP-AMP AS FILTERS: Characteristics of filters, Classification of filters, Magnitude and frequency response, Butterworth 1st and 2nd order Low pass, High pass and band pass filters, Chebyshev filter characteristics, Band reject filters, Notch filter; all pass filters, self-tuned filters, AGC,AVC using op-AMP.

TIMER:IC-555 Timer concept, Block pin configuration of timer. Monostable, Bistable and AstableMultivibrator using timer 555-IC, Schmitt Trigger, Voltage limiters, Clipper and clampers circuits, Absolute value output circuit, Peak detector, Sample and hold Circuit, Precision rectifiers, Voltage-to-current converter, Current-to-voltage converter.

Voltage Regulator: simple OP-AMP Voltage regulator, Fixed and Adjustable Voltage Regulators, Dual Power supply, Basic Switching Regulator and characteristics of standard regulator ICs such as linear regulator, Switching regulator and low-drop out regulator. Study of LM317, TPS40200 and TPS7250

TEXT BOOKS:

2. Ramakant A. Gaikward, "OP- Amp and linear Integrated circuits" Third edition 2006, Pearson.
3. B. Visvesvara Rao Linear Integrated Circuits Pearson.
4. <http://www.nptelvideos.in/2012/11/analog-ics.html>
5. <http://nptel.ac.in/courses/117108107/>

REFERENCES:

1. David A. Bell: Operational Amplifiers & Linear ICs, Oxford University Press, 2nd edition, 2010.
2. D. Roy Choudhury: Linear Integrated Circuits New Age Publication.
3. B. Somanathan Nair: Linear Integrated Circuits analysis design and application Wiley India Pvt. Ltd.
4. Maheshwary and Anand: Analog Electronics, PHI.
5. S. Salivahanan, V S Kanchana Bhaaskaran: Linear Integrated Circuits", second edition, McGraw Hill.
6. Gray Hurst Lewis Meyer Analysis and design of analog Integrated Circuits fifth edition Wiley India.
7. Robert F. Coughlin, Frederick, F. Driscoll: Operational Amplifiers and Linear Integrated Circuits, sixth edition, Pearson.
8. Millman and Halkias: Integrated electronics, TMH.
9. Boylestad and Nashelsky: Electronic Devices and Circuit Theory, Pearson Education.
10. Sedra and Smith: Microelectronics, Oxford Press.

List of Experiments :

Apparatus Required – Dual Channel Cathode Ray Oscilloscope (0-20 MHz), Function Generator (10 MHz and above), Dual Power Supply, LM741, TL082, MPY634, TPS7250, Probes, digital multimeter.

1. To measure and compare the op-amp characteristics: offset voltages, bias currents, CMRR, Slew Rate of OPAMP LM741 and TL082.
2. To determine voltage gain and frequency response of inverting and non-inverting amplifiers using TL082.
3. To design an instrumentation amplifier and determine its voltage gain using TL082.
4. To design op-amp integrator (low pass filter) and determine its frequency response.
5. To design op-amp differentiator (high pass filter) and determine its frequency response.
6. Design 2nd order Butterworth filter using universal active filter topology with LM741
7. To design Astable, Monostable and Bistable multivibrator using 555 and analyse its characteristics.
8. Automatic Gain Control (AGC) Automatic Volume Control (AVC) using multiplier MPY634
9. To design a PLL using op-amp with MPY634 and determine the free running frequency, the capture range and the lock in range of PLL
10. Design and test a Low Dropout regulator using op-amps for a given stage regulation characteristic and compare the characteristics with PS7250 IC.

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ED 406- Computer Workshop (Introduction to Linux and Python for Scripting)

S. No.	List of experiment
1	To study basic & user status Unix/Linux commands.
2	Study & use of commands for performing arithmetic operations with Unix/Linux.
3	Create a file and display how many lines, words and characters are present in that file using shall commands.
4	Give two files each of which contain names. Use shall commands to display only those names that are found on both the files.
5	Implement shall commands to find out the mode number of any desired file.
6	Study & use of the commands for changing file permission.
7	Write a pipeline of commands, which display on the monitor as well as saves the information about the number of users using the system at same time.
8	Basic Arithmetic Operations: Write a script to perform basic arithmetic operations (addition, subtraction, multiplication, division) and logical operations.
9	Binary and Hexadecimal Conversion: Develop a script to convert numbers between binary, hexadecimal, and decimal formats.
10	Truth Table Generator: Create a script that generates the truth table for basic logic gates (AND, OR, NOT, NAND, NOR, XOR, XNOR).
11	Logic Gate Simulator: Build a simple logic gate simulator that takes Boolean expressions as input and evaluates the output.
12	Bitwise Operations: Write a script to perform bitwise operations (AND, OR, XOR, NOT, left shift, right shift) on integers.
13	Combinational Circuit Simulator: Develop a script that simulates basic combinational circuits, like adders (half-adder, full-adder), multiplexers, and demultiplexers.
14	Sequential Circuit Simulator: Create a script that simulates simple sequential circuits like flip-flops (SR, D, JK, T) and registers.
15	Binary Adder/Subtractor: Write a script to implement a binary adder/subtractor that can handle binary inputs and outputs the result.
16	Waveform Generator: Build a script that generates basic digital waveforms (square wave, clock signal) and visualizes them using matplotlib.
17	Data Parsing and Analysis: Develop a script to parse and analyze simulation data (e.g., from SPICE simulations) and generate reports.
18	Finite State Machine (FSM) Simulator: Create a script to simulate and visualize the behavior of simple finite state machines.
19	Verilog/VHDL Parser: Write a basic parser to analyze Verilog or VHDL code and extract information such as module names, ports, and parameters.
20	Timing Diagram Generator: Develop a script to generate timing diagrams from a set of digital signals and visualize them.
21	Signal Integrity Checker: Build a script to check for signal integrity issues such as glitches and metastability in digital signals.
22	Basic Circuit Analysis Tool: Create a script that performs basic circuit analysis calculations, such as resistance, capacitance, and inductance calculations.
23	HDL Code Linter: Write a basic linter for Verilog or VHDL code to enforce coding standards and catch common errors.