RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics & Instrumentation Engineering, V-Semester

EI 501 Process Instrumentation-I

Unit-1
Introduction to process control, Control system Evaluation, Objective,ON-OFF control, Timeproportional control, proportional control, Integral control, Derivative control, Typical PID controller characteristics and related terminology.

Unit-2
Pneumatic controller: P, PD, PI, PID controllers. Hydraulic controller: P, PI, PD, PID controller,Electronic controller. Complex control schemes: ratio control systems, split range controls, cascade controls, feed forward control, Tuning of controllers: Ziegler-Nicolas methods and other methods.

Unit-3
Introduction to programmable logic controllers: Evolution, basic block diagram, characteristics,advantages, types, PLC Vs PC. Ladder diagram, Ladder design, development of Ladder diagrams for various logic gates, logics. PLC timers and counters, Application of PLCs: Industrial applications.

Unit-4
Final control elements: Mechanical, Electrical, Fluid valves: control valve principles, valvesport and plug and characteristics, control valve types, Valve sizing and selection. Type of actuators: Pneumatic actuators, Hydraulic actuators.

Unit-5
Feedback and connecting elements in the loop flow, pressure level and temperature control loops,Pneumatic transmission, electric transmission, Thermal element lag, pressure element lag.

Assessment: Evolution of students done through -

Assignments, Tutorials, Seminars,Quiz, Mid Semester Test exam, class performance & End exam of Session .

List of Experiment:
1. Experiment to obtain Pressure-displacement characteristics of Flapper Nozzle amplifier.
2. Experiment to maintain constant flow of liquid using PID controller (flow control system).
3. Study of feedback flow loop from supervisory station.
4. Experiment to maintain constant liquid level in a tank using PID controller (level control system).
5. Study of feedback level control plant from supervisory station.
6. Study of cascade control system.
7. Study of feedback pressure control system.
8. Control of temperature of heating fluid using PID controller (heat exchanger).
9. Study of PLC based rotary bottle filling system.
10. Study of PLC based On-OFF level control system.
11. Study of PLC based Lift simulator.

Assessment: Evolution of students done through –

Best one experiment performance, internal viva,external viva, File preparation and submission

Text Books:

1. Eckman- Automatic Process Control.
2. D.Patranabis- Principles of Process Control.
3. Curties D. Johnson- Process Control Instrumentation Technology.

References Books:

4. S. K. Singh - Industrial Instrumentation.
5. Mitra& Gupta- Programmable Logic Controller and Industrial Automation

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Electronics & Instrumentation Engineering, V-Semester

EI 502 Microprocessor & Micro Controller

Unit-1
Microprocessor 8086 Introduction to 16-bit 8086 microprocessors, architecture of 8086,Pin Configuration, mode, timing diagram, Memory interfacing, interrupts, Instruction set of 8086, Addressing mode, Assembler directives & operations, assembly and machine language programming, subroutine call and returns, Concept of stack, Stack structure of 8086, timings and delays.

Unit-2
Input-Output interfacing: Memory Mapped I/O and Peripherals I/O. PPI 8255 Architecture and modes of operation, Interfacing to 16-bit microprocessor and programming, DMA controller (8257) Architecture, Programmable interval timer 8254, USART 8251.

Unit-3
Microcontroller 8051 Intel family of 8 bit microcontrollers, Architecture of 8051, Pin description, I/O configuration, interrupts; Interrupt structure and interrupt priorities, Port structure and operation, Accessing internal & external memories and different mode of operations, Memory organization, Addressing mode, instruction set of 8051 and programming.

Unit-4
8051 Interfacing, Applications and serial communication 8051 interfacing to ADC and DAC, Stepper motor interfacing, Timer/ counter functions, 8051 based thyristor firing circuit, 8051 connections to RS-232, 8051 Serial communication , Serial communication modes, Serial communication programming, Serial port programming inC.

Unit-5
Microcontroller 8096 Introduction to 16-bit Microcontroller, functional block-diagram, memory status, complete 8096 instruction set, classification of instruction set, addressing modes, programming examples using 8096, hardware features of 8096,parallel ports, control &status Registers, Introduction to 16/32 bit PIC microcontrollers and DSPIC.

Practical:
List of Experiments
1. Programs for 16 bit arithmetic operations for 8086 (using Various Addressing Modes).
2. Program for sorting an array for 8086.
3. Program for searching for a number or character in a string for 8086
4. Program for string manipulations for 8086.
5. Program for digital clock design using 8086.
6. Interfacing ADC and DAC to 8086.
7. Parallel communication between two microprocessors using 8255.
8. Serial communication between two microprocessor kits using 8251.
9. Interfacing to 8086 and programming to control stepper motor.
10. Programming using arithmetic, logical and bit manipulation instructions of 8051.
11. Program and verify Timer/Counter in 8051.
12. Program and verify Interrupt handling in 8051.
13. UART Operation in 8051.
14. Communication between 8051 kit and PC.
15. Interfacing LCD to 8051.
16. Interfacing Matrix/Keyboard to 8051.
17. Data Transfer from Peripheral to Memory through DMA controller 8237/8257.

Note: Minimum of 12 experiments to be conducted.

Text Books:

1. Hall Douglas V., Microprocessor and interfacing, Revised second edition 2006, Macmillan, McGraw Hill .
2. A.K. Ray & K.M. Bhurchandi, Advanced Microprocessors and peripherals-Architecture, Programming and Interfacing, Tata McGraw - Hill, 2009 TM Hreprint.
3. SenthilkumarSaravananjeevananthan shah,Microprocessors and Interfacing, oxford university press, 2012.
4. Kenneth J. Ayala, The 8086 microprocessor: programming and interfacing the PC, Indian -edition, CENGAGE Learning.
5. Muhammad Ali Mazidi and Janice Gillespie Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson education,2005.
6. Kenneth J. Ayala, The8051 Microcontroller Architecture, III edition, CENGAGE Learning.
7. V. Udayashankara and M.S. Mallikarjunaswamy, 8051 Microcontroller: Hardware, Software & Applications, Tata McGraw - Hill,2009.
8. McKinlay, The 8051 Microcontroller and Embedded Systems - using assembly and C, PHI, 2006 / Pearson,2006.
9. Tim Wilmshurst, Designing embedded system with PIC microcontrollers Principles and applications. 2nd ed. 2011 Bsp books pvtltd.

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Electronics & Instrumentation Engineering, V-Semester

Departmental Elective EI 503 (A) ADC (Analog & Digital Communication)

Unit-1

Signals and Random Variables: Types of signals: deterministic & random, periodic & non-periodic, analog & discrete, energy & power signals. Fourier series, Fourier transform and its properties, Gaussian and Rayleigh probability density function, mean, variance and standard deviation, central limit theorem, Voltage & Power decibel Scales.

Unit-2

Amplitude Modulation: Need of modulation in a communication system, block schematic of a typical communication system. AM modulation system, modulation index, generation & detection of AM wave, side bands & power content in an AM wave, DSB-SC, SSB, their methods of generation & detection, AM transmitter block diagram.

Unit-3

Frequency Modulation: Relationships between phase & frequency modulation, FM wave & its spectrum, Phasor diagram of narrowband FM signal, wideband FM, methods of generation & detection of FM, discriminators, pre-emphasis & de-emphasis.

Unit-4

Receivers and Noise: TRF receiver & its limitations, necessity of heterodyning, Super heterodyne radio receivers, IF amplifiers & selection of intermediate frequency, RF amplifiers, detectors. Sources of noise, noise figure, noise bandwidth, effective noise temperature.

Unit-5

Introduction to Digital Communication: Nyquist sampling theorem, time division multiplexing, Pulse modulations and PCM, quantization error, introduction to BPSK & BFSK, Shannon's theorem for channel capacity.

Assessment: Evolution of students done through -

Assignments, Seminars ,Quiz, Mid sem Test exam, class performance & End exam of Session .

Text Books:

1. Lathi B.P.,Anolog and Digital Communication Systems, Oxford Press.
2. Singh R.P. &Sapre, Communication Systems Analog& Digital, TMH.
3. Kennedy George, Electronic Communication System, McGraw Hill.

References Books:

1. Haykin Simon, Communication Systems, John Willey & Sons.
2. Taub& Schilling, Principles of Communication Systems, McGraw Hill.

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Electronics & Instrumentation Engineering, V-Semester

Departmental Elective EI 503 (B) Industrial Automation

Unit-1
Automation: Definition of automation, types of automation, merits & demerits, application in instrumentation. Automatic test system configuration: GPIB bus talker/ listener/ controller, IEEE compatible programmable instruments, specification & operation. PC based instrument controller, computer controlled instruments system Programmable oscilloscope, Programmable function generator.

Unit-2
Automatic performance evolution of electronic system & instrumentation: Data logger, programmable data logger configurations, SCADA & PLC systems, Operation of data logger, applications of data logging systems, Condition monitoring, failure of plants/ components.

Logical fault finding, maintenance logging, vibration monitoring, noise level, thermal sensing, infrared, ultrasonic condition monitoring, Quality control & automated inspection: Sensor technology for automated inspection, machine vision.

Unit-3
Microcomputer based numerical control system: Types of numerical control machines Part programming, Computer numerical control machine tools.

Unit-4
Automatic testing of electronic components: Operational amplifier. Digital integrated circuits, Sample & hold circuit/ switches/multiplexers. Instrumentation amplifier Switches in automated test systems. Virtual instruments: Basic components of virtual components, using virtual instruments.

Unit-5
Case studies: Hardware & software design of Bottle filling plant, Automated guided vehicle system, Automated milk & food processing system.

Assessment: Evolution of students done through -

Assignments, Seminars,Quiz, Midsem Test exam, class performance & End exam of Session.

Text Books:

1. Kocher A.K. & Burns N.D., Microprocessors & their manufacturing applications
2. Mikell P. Groover, Automation, Production system & Computer integrated manufacturing, Pearson EducationClyde F. C

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Electronics & Instrumentation Engineering, V-Semester

Departmental Elective EI 503 (C) Control System

Unit-1

Modelling of Dynamic Systems and Simulation-Integral-differential equations of linear systems such as mechanical, hydraulicpneumatic and electrical systems, Block diagram and Signal flow graph method of representing the dynamic equations, Analogue simulation, linearity, impulse response and concept of transfer function, Mason's gain formula, control systems components - Error detectors, a-c and d-c Servomotors, servo-amplifiers (a-c & d-c) using operational amplifiers, Gyro, Resolver. Typical study of characteristics of these components, Concept of feedback as control theory - mathematical theory of feedback, return ratio, return difference, open and closed loop, understanding the necessity of feedback as real control action supplemented by a small example.

Unit-2

Time-Domain Analysis of Feedback Control Systems - Typical reference test signals and their significance, transient behaviour of closed loop systems under feedback control, Proportional plus derivative and rate feedback control actions for improving the transient response, Steady state behaviour of closed loop feedback control systems, Types of open loop transfer functions, Steady state errors, Proportional plus integral control action for the improvement of steady state errors.

Unit-3

Frequency-Domain Analysis of Feedback Control Systems - Concept of frequency-domain analysis, Bode plots, Polar plots. Bode of closed loop transfer function Mp and, Bode plots of error transfer functions, Principle of Argument, Nyquist criteria. Conditionally stable closed loop systems, Transportation lag, Constant M and constant N loci, Loci of closed loop poles (root loci).

Unit-4

Compensation Techniques - Need for frequency-domain compensation, Different types of compensation, Phase-lead and Phase-lag compensation, Design of compensating networks for the desired frequency-domain closed loop performance.

Unit-5

State Space Method of Analysis - Fundamentals of state space: concept of state and state variable, Representation of linear system through state dynamics, Calculation of Eigen-values and Eigen-vectors, Modal matrix, Modal transformation, Elementary understanding controllability and observability,state feedback control. Stability analysis of feedback control systems - concept of stability, BIBO stability, Asymptotic stability, Routh-Hurwitz stability analysis. Nyquist stability analysis and relative stability, gain margin and phase margin.

Text Books:

1. B. C. Kuo, “Automatic Control Systems”, Prentice Hall, New York.
2. K. Ogata, “Modern Control Engineering”, Prentice-Hall of India Ltd, New Delhi.
3. J. L. Melsa& D. G. Schultz, “Linear Control Systems”, McGraw Hill, New York.

Reference Books:

1. J. Nagrath& M. Gopal, “Control Systems Engineering”, New Age International (P) Ltd, New Delhi

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Electronics & Instrumentation Engineering, V-Semester

Open Elective EI 504 (A) Virtual Instrumentation

Unit-1
Review of Digital Instrumentation
Representation of analog signals in the digital domain – Review of quantization in amplitude and time axes, sample and hold, sampling theorem, ADC and DAC.

Unit-2
Fundamentals of Virtual Instrumentation
Concept of virtual instrumentation – PC based data acquisition – Typical on board DAQ card – Resolution and sampling frequency - Multiplexing of analog inputs – Single-ended and differential inputs – Different strategies for sampling of multi-channel analog inputs. Concept of universal DAQ card - Use of timer-counter and analog outputs on the universal DAQ card.

Unit-3
Cluster of Instruments In VI System
Interfacing of external instruments to a PC – RS232, RS 422, RS 485 and USB standards - IEEE 488 standard – ISO-OSI model for serial bus – Introduction to bus protocols of MOD bus and CAN bus.

Unit-4
Graphical Programming Environment in VI
Concepts of graphical programming – Lab-view software – Concept of VIs and sub VI - Display types – Digital – Analog – Chart – Oscilloscopic types – Loops – Case and sequence structures - Types of data – Arrays – Formulae nodes –Local and global variables – String and file I/O.

Unit-5
Analysis Tools And Simple Applications In VI
Fourier transform - Power spectrum - Correlation – Windowing and filtering tools – Simple temperature indicator – ON/OFF controller – P-I-D controller - CRO emulation - Simulation of a simple second order system – Generation of HTML page.

Text Books
1. S. Gupta and J.P Gupta, 'PC Interfacing for Data Acquisition and Process Control', Instrument society of America, 1994.
2. Peter W. Gofton, 'Understanding Serial Communications', Sybex International.
3. Robert H. Bishop, 'Learning with Lab-view', Prentice Hall, 2003.

Reference Books
1. Kevin James, 'PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control', Newness, 2000.
2. Gary W. Johnson, Richard Jennings, 'Lab-view Graphical Programming', McGraw Hill Professional Publishing, 2001.

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Electronics & Instrumentation Engineering, V-Semester

Open Elective EI 504 (B) EDA Tools

Unit-1
MATLAB: The MATLAB environment - Basic computer programming - Variables and constants, operators and simple calculations - Formulas and functions, Vectors and matrices, Matrix operations and functions

Unit-2
Spice: Introduction, design of - Potential divider network RC integrating and Diode, BJT and MOSFET characteristics differentiating circuits Diode Circuits (Clipping, Clamping, Rectifiers) AstableMultivibrator, half adder /full adder circuits using gates

Unit-3
PCB Design Software: Various PCB design software, applications, PCB design process.

Unit-4
TANNER TOOL: Introduction, S-Edit, L- Edit, T- Spice, and LVS.

Unit-5
Lab view: Introduction, Programming, application development, error handling and debugging, simulation, math script

Assessment: Evolution of students done through -

Assignments, Seminars, Quiz, Midsem Test exam, class performance & End exam of Session.

References:

1. About the EDA Industry". Electronic Design Automation Consortium. Archived from the original on August 2, 2015. Retrieved July 29, 2015.
2. Lavagno, Martin, and Scheffer (2006). Electronic Design Automation For Integrated Circuits Handbook. Taylor and Francis. ISBN 0849330963.
3. Company Comparison - Google Finance. Google.com. Retrieved on 2013-08-10.

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Electronics & Instrumentation Engineering, V-Semester

Open Elective EI 504 (C) DSP Processors

Unit-1

An introduction to DSP Processors: Advantages of DSP characteristics of DSP systems,classes of DSP applications.DSP processor embodiment and alternatives,Fixed Vs Floating point processors,fixed point and floating point data path.

Unit-2

DSP Architecture : An introduction to Harvard Architecture,Differentiation between Von-Neumann and Harvard Architecture,Quantization and finite word length effects, Bus structure, Central Processing unit – ALU, Accumulators,Barrel shifters, MAC unit, compare, select, and store unit (CSSU),data addressing and program memory addressing

Unit-3

Memory architecture :Memory structures features for reducing memory access required ,wait states,external memory interfaces,memory mapping – dta memory,programmemory,I/O memory , memory mapped registers .Addressing: Various addressing modes -implied addressing,immediate data addressing,memory direct addressing ,register direct and indirect addressing and short addressing modes. Instruction set: Instruction types, various type of registers,orhogonality assembly language and application development.

Unit-4

Execution Control and pipelining: Hardware looping , interrupts, stack , pipelining and performance, pipelining depth, interlocking , branching effects, interrupt effects, instruction pipelining,. Peripherals: Serial ports, timers, parallel ports, Bit input/output ports, Host ports, communication ports, on-chip A/D and D/A converters, external interrupts, on-chip debugging facilities, power consumption and management.

Unit-5

Processors:Architecture and instruction set of TMS320C3x, TMS320C5x, TMS320C6x,ADSP21xx DSP chips, some examples programs.Recent trends in DSP system Design: FPGA based DSP system design, advanced development tools for FPGA, development tool for programmable DSP's- An introduction to Code composer studio.

References:

1. P. Lapsley, J. Bier,A.Shoham,E.A.lee:DSP processor fundamentals:Architectures and Features,IEEE Press series on signal processing,IEEE.
2. B venkataramani and M bhaskar: Digital signal Processors: Architectures, programming and applications,TMH.

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Electronics & Instrumentation Engineering, V-Semester

EI 505 Instrumentation Workshop

Unit-1
Familiarization/Identification of electronic components with specification, Functionality, type, size, colour coding, package, symbol, cost etc. [Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.]

Unit-2
Familiarization / Application of testing instruments and commonly used tools [Multi-meter, Function generator, Power supply, CRO etc.] [Soldering iron, De-soldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de- soldering station etc.]

Unit-3
Testing of electronic components[Resistor, Capacitor, Diode, Transistor, UJT and JFET using multi-meter].

Unit-4
Inter-connection methods and soldering practice [Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions, soldering practice in connectors and general purpose PCB, Crimping]. Printed circuit boards (PCB) [Types, Single sided, Double sided, PTH, Processing methods, Design and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling].

Unit-5
Assembling of electronic circuit/system on general purpose PCB, test and show the functioning.

Assessment: Evolution of students done through -

Assignments, Seminars, Quiz, Midsem Test exam, class performance & End exam of Session.

Text Books:
1. A.K. Sawhney, Electrical & Electronic Measurement & Instrumentation.