RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics & Instrumentation Engineering, VI-Semester

EI 601 Process Instrumentation-II

Pre-Requisite: Knowledge of Sensors and Transducers, Control Systems

Course Outcomes:

CO1: To Analyse process control system and evaluation.
CO2: Application of pneumatic and electronic controller in control systems.
CO3: To describe PLC and ladder programming for designing various logics.
CO4: To discuss final control elements
CO5: Toe employ PLC and ladder programming to real world scenario.

Course Content:

Theory:

UNIT-1. Introduction to process control. Control system Evaluation, Objective. ON-OFF control. Time proportional 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:

Continuous evaluation of students through: Class attendance, Assignments, organizing Seminars/Quizzes and two mid Semester Tests Exam with weightage of 30% of total marks. End semester theory exam. Weightage is 70% of total marks.

Practicals:

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: Evaluation of students through –

Continuous performance analysis of students based on experiment performance, File preparation, internal viva and file submission with weightage of 40% of total marks and End Semester practical Examination (external viva) with weightage of 60% of total marks.

Text Books :

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

References Books:

1. S. K. Singh - Industrial Instrumentation.
2. Mitra& Gupta- Programmable Logic Controller and Industrial Automation

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Electronics & Instrumentation Engineering, VI-Semester

EI 602 Embedded System

Course Objectives:

CO 1: Analyze the basic concepts and architecture associated with different microcontrollers families.
CO 2: Descriptive view about 8051 family of microcontrollers and designing assembly language programs for Different scenarios and calculations.
CO 3: Illustration of different devices interfacing with 8051 microcontroller.
CO 4: Brief overview of Motorola series microcontrollers.
CO 5: Evaluation of embedded system, its characteristics and applications by using few case studies.
CO6: To discuss various software architecture of embedded systems.

Unit-1. Introduction to microcontrollers, Features of various families. Support chips & interfacing with peripherals and memory chips.

Unit-2. 8051 Family of Microcontroller. Features and Architecture, Programming model ,GPRs & SFRs, timer interrupts, instruction set & timing diagram, Assembly language programming. Developing - Debugging tools.

Unit-3. Motorola Series microcontrollers. Programming model, GPRs & SFRs, timer, interrupts. Architecture Features, Instruction set, timing diagram and programming of 68HC11 series. Interfacing with transducers/sensors.

Unit-4. Embedded systems, Characteristics and their applications, Design cycle, planning and development of project. Few case studies

Unit-5. Various Software architecture of embedded systems. Real time operating system, Applications of embedded systems.

BOOKS & REFERENCES RECOMMENDED:

1.Muhammad Ali Mazidi, Janice GillispieMazidi, The 8051 Microcontroller and embedded systems
2.Microprocessor and Interfacing, Programming and hardware by Douglas V. Hall, McGraw Hill.
3.Jonathan.W.Valvano, Embedded Microcomputer Systems" Brooks-Cole Publilshers.
4.An Embedded software premier By David E. Simon Addison-Wesley.

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New Scheme Based On AICTE Flexible Curricula

Electronics & Instrumentation Engineering, VI-Semester

Departmental Elective EI 603 (A) DSP (Digital Signal Processing)

Course Outcomes:-

CO1: Learn characteristics of signals & systems like time invariant, linear nonlinear, causal etc.
CO2: Gain knowledge of Z-transform & analyzing discrete system using Z-transform.
CO3: Designing digital filters & their implementation.

Unit-1. Discrete time signals & systems : Introduction, types of signals, discrete time signal sequences, discrete time systems, linear shift invariant systems, Stability & causality, linear constant coefficient difference equation, frequency domain representation of discrete time systems & signals, properties of the Discrete Time Fourier transform (DTFT), Sampling and discrete time processing of continuous-time signals.

Unit-2. Z-Transform and Transform analysis of LTI systems: Z-transform, Inverse Z-transform, properties of Z-transform, one sided Z-transform and its applications, system function, frequency response of LTI systems, minimum phase and linear phase systems.

Unit-3. Discrete Fourier transform(DFT),and its computation: Discrete Fourier Series, Discrete Fourier Transform, Linear convolution using Discrete Fourier Transform, Computation of DFT, Goertzel's Algorithm, Decimation in time FFT algorithms, Decimation in frequency algorithms, FFT algorithms for N (a composite number), chirp Z-transform algorithm.

Unit-4. Implementation of digital filters: Signal flow graph representation, Realization of IIR & FIR systems, direct form, Transposed form, Parallel form, Cascade form, Lattice structure for IIR and FIR filters, Parameter quantization effect.

Unit-5. Digital filter design techniques: Design of IIR digital filters using Impulse-invariant and bilinear transformation methods, Design of FIR filter using Windowing methods, Design examples.

Text Books:

1. Oppenheim & Schafer, Discrete Time Signal Processing, Pearson Education.
2. Proakis, Digital Signal Processing, Pearson Education.
3. MitraSanjit, Digital Signal Processing A Computer Based Approach, TMH

Reference Books:

4. Schaum's Outline Series, Digital Signal Processing.
5. Ludeman L.C., Fundamantels of DSP, John Wiley.
6. Farooq Husain, DSP and its Application, UmeshPubl, New Delhi.

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Electronics & Instrumentation Engineering, VI-Semester

Departmental Elective EI 603 (B) Power Electronics

PRE- REQUISITE: Basic knowledge of Electronics and semiconductor devices.

COURSE OBJECTIVES:

- To provide students a deep insight in to the operational behavior of practical power switching devices with respect to their static and dynamic characteristics
- To learn the working principle of classified topologies of Thyristor based AC/DC, AC/AC, DC/DC and DC/AC converters.
- To design and analyze the operation of above converters considering their applications.
- To understand design of firing circuits for Thyristor based line commutated converters.

COURSE OUTCOMES:

EE47002(T).1: Acquire knowledge about fundamental concepts and switches used in power electronics
EE47002(T).2: Ability to analyze various single phase and three phase line commutated power converter circuits and understand their applications.
EE47002(T).3: Nurture the ability to identify basic requirements for line commutated converter based design application.
EE47002(T).4: To develop skills to build, and troubleshoot power electronics circuits.

EE47002(T).5: Understand the firing circuit design for line commutated converters
EE47002(T).6: Foster ability to understand the use of line commutated converters in professional engineering.

COURSE CONTENTS:

THEORY:

UNIT: 1
Static power devices: Thyristor family, two transistor analogy of SCR, construction, characteristics, parameters, turn on and turn off methods, firing circuits, isolation and amplifier circuits, synchronization circuits.

UNIT: 2
Converters: AC to DC converters, single phase rectifier circuits with different load, various quadrant operation, basic principle and power circuits of dual converter and cycloconverter

UNIT: 3
DC to DC converter: Basic principle of chopper circuits, various chopper circuits and their working, stepup chopper, performance analysis.

UNIT: 4
Inverters: CSI and VSI inverters, single phase inverters, principle of operation, voltage and frequency control techniques.

UNIT: 5
Industrial Application of Power Electronics, SMPS, UPS, AC and DC drives, Power Supplies.

ASSESMENT:

A. Continuous evaluation through two mid-term test with a weightage of 30% of the total marks. It includes class attendance as well as assignments on the course topics.
B. The end-term theory examination weightage is 70%.

PRACTICALS:

List of Experiments

1. Verification of steady state characteristics of different static switches.
2. Phase control of TRIAC using DIAC and RC circuit in light dimming circuit.
3. Firing pulse generation using UJT based relaxation oscillator.
4. Firing pulse generation for SCR using TCA 785 IC.
5. Performance evaluation of single phase uncontrolled converter for R, RL load.
6. Performance evaluation of single phase controlled converter for R, RL load.
7. Performance Analysis of step down chopper
8. Performance evaluation of current commutation circuit for SCR
9. Performance evaluation of voltage commutation circuit for SCR.
10. Effect of duty cycle on the output voltage of buck-boost converter.

ASSESMENT:

A. Continuous evaluation of laboratory journals with a weightage of 40%. It includes lab attendance as well as experiments performed in the lab.
B. The end-term practical examination weightage is 60%.

TEXT BOOKS RECOMMENDED:

1. M H Rashid, “Power Electronics Circuits, Devices, and Applications”, third edition Pearson/Prentice Hall, 2009.
2. Ned Mohan, “Power Electronics: Converters, Applications, and Design”, third edition, John Wiley & Sons Inc, 2007.
3. Joseph Vithayathil, “Power Electronics Principles and applications”, Tata McGraw-Hill, 1995.

REFERENCES BOOKS:

1. C. M. Pauddar, “Semiconductor Power Electronics (Devices and Circuits)”, first edition, Jain Brothers New Delhi, 1999.
2. M. H. Rashid, “Handbook of Power Electronics”, Pearson Education India, 2008.
3. M. D. Singh, K. B. Khanchandani, “Power Electronics”, Tata McGraw-Hill, 2008.

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Electronics & Instrumentation Engineering, VI-Semester

Departmental Elective EI 603 (C) Nuclear Instrumentation

Unit-1: Radioactivity : General properties of Nucleus, Radioactivity, Nature of Nuclear Radiation's, Properties of Alpha, Beta and Gamma rays, Natural and artificial radioactivity. Radioactivity Laws, Half life period, radioactive series, Isotopes and Isobars, Various effects-photoelectric, Compton scattering and pair production, stopping power and range of charged nuclear particles.

Unit-2: Radiation Detectors : Techniques for radiation detection, Detectors for Alpha, beta and gamma rays, Detector classification,Gas filled detectors - volt ampere characteristics, Ionization chamber, Proportional counter, Geiger Muller counter, Designing features, Scintillation detectors, Photomultiplier tube, dark currents, pulse resolving power, efficiency of detection, Solid state detectors (Lithium ion drifted – Si-Li, Ge-Li, Diffused junction, surface barrier detectors)

Unit-3: Electronics and Counting systems: Pre-amp, shaping amplifiers, Discriminators, Scalars and count rate meters, Pulse shaping, peak stretchers, photon counting system block diagram, single channel analyzer SCA (pulse height analyzer - PHA), Coincidence detection

Unit-4: Nuclear Spectroscopy systems: Factors influencing resolution of gamma energy spectrum, Energy resolution in radiation detectors, Multichannel analyzers (MCA), Role of Nuclear ADC's – performance parameters, Radiation Monitors &Application in Medicines : Radiation uptake studies – block diagram and design features. Gamma camera – design, block diagram, medical usage. Nuclear instrumentaion for health care, Radiation Personnel Health Monitors like neutron monitors, Gamma Monitors, Tritium monitors, Iodine monitors and PARA (paritculateacitivity radiation alarms).

Unit-5: Applications in Industry : Basic Nuclear Instrumentation system – block diagram, Personal monitors like Thermo Luminescence Detectors (TLD). Dosimeters, Teledetectors. Nuclear Instrumentation for power reactor. Nuclear Insrumentation for Toxic fluid tank level measurement, weighing, thickeness gauges, Agriculture applications like food irradiation, Underground Piping Leak detection, water content measurement etc.

Text Books:

1. G.F. Knoll, “Radiation Detection & Measurement”, 2nd edition, John Wiley & Sons, 1998. 2. P.W. Nicholson, “Nuclear Electronics”, John Wiley, 1998. 3. S.S. Kapoor & V.S. Ramamurthy, “Nuclear Radiation Detectors”, Wiley Easter Limited, 1986.

Reference Books:

1. Gaur & Gupta, “Engineering Physics”, Danpat Rai & Sons, 2001.

2. Irvin Kaplan, “Nuclear Physics”, Narosa, 1987.

3. M.N. Avdhamule& P.G. Kshirsagar, “Engineering Physics”, S.Chand& Co., 2001.

4. R.M. Singru, “Introduction to Experimental Nuclear Physics”, Wiley Eastern Pvt. Ltd., 1974.

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Electronics & Instrumentation Engineering, VI-Semester

Open Elective EI 604 (A) Internet of Things

Unit 1: Introduction to IoT Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs

Unit-2: IoT & M2M Machine to Machine, Difference between IoT and M2M, Software define Network, Network & Communication aspects Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

Unit-3: Challenges in IoT Design challenges, Development challenges, Security challenges, Other challenges

Unit-4: Domain specific applications of IoT Home automation, Industry applications, Surveillance applications, Other IoT applications

Unit-5: Developing IoTs Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python.

Reference Books:

1. Vijay Madisetti, ArshdeepBahga, “Internet of Things: A Hands-On Approach”

2. WaltenegusDargie,ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

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Electronics & Instrumentation Engineering, VI-Semester

Open Elective EI 604 (B) Robotics

UNIT I-Introduction History of robots, Classification of robots, Present status and future trends. Basic components of robotic system. Basic terminology- Accuracy, Repeatability, Resolution, Degree of freedom. Mechanisms and transmission, End effectors, Grippers-different methods of gripping, Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, Cam type gripper, Magnetic grippers, Vacuum grippers, Air operated grippers; Specifications of robot

UNIT II- Drive systems and Sensors Drive system- hydraulic, pneumatic and electric systems Sensors in robot – Touch sensors, Tactile sensor, Proximity and range sensors, Robotic vision sensor, Force sensor, Light sensors, Pressure sensors.

UNIT II- Kinematics and Dynamics of Robots 2D, 3D Transformation, Scaling, Rotation, Translation, Homogeneous coordinates, multiple transformation, Simple problems.

Unit IV Matrix representation, Forward and Reverse Kinematics Of Three Degree of Freedom, Homogeneious Transformations, Inverse kinematics of Robot,Robot Arm dynamics, D-H representationof robots, Basics of Trajectory Planning. **UNIT V**-Robot Control, Programming and Applications Robot controls-Point to point control, Continuous path control, Intelligent robot, Control system for robot joint, Control actions, Feedback devices, Encoder, Resolver, LVDT,Motion Interpolations, Adaptive control. Introduction to Robotic Programming, On-line and off-line programming, programming examples. Robot applications-Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting.

Text Books:

1. Mikell P Groover, Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, “Industrial Robotics, Technology programming and Applications", McGraw Hill, 2012.
2. Craig. J. J. “Introduction to Robotics- mechanics and control”, Addison- Wesley, 1999.

Reference Books:

1. S.R. Deb, “Robotics Technology and flexible automation”, Tata McGraw-Hill Education., 2009.
2. Richard D. Klafter, Thomas .A, ChriElewski, Michael Negin, "Robotics Engineering an Integrated Approach", PHI Learning., 2009.
3. Francis N. Nagy, Andras Siegler, "Engineering foundation of Robotics", Prentice Hall Inc., 1987.

4. P.A. Janaki Raman, "Robotics and Image Processing an Introduction", Tata McGraw Hill Publishing company Ltd., 1995.
5. Carl D. Crane and Joseph Duffy, "Kinematic Analysis of Robot manipulators", Cambridge University press, 2008.
6. Fu. K. S., Gonzalez. R. C. & Lee C.S.G., “Robotics control, sensing, vision and intelligence”, McGraw Hill Book co, 1987 [R7] Ray Asfahl. C., “Robots and Manufacturing Automation”, John Wiley & Sons Inc.,1985

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New Scheme Based On AICTE Flexible Curricula

Electronics & Instrumentation Engineering, VI-Semester

Open Elective EI 604 (C) Oil and gas instrumentation

1. PETROLEUM PROCESSING

Petroleum exploration – Recovery techniques – Oil – Gas separation - Processing wet gases – Refining of crude oil.

2. OPERATIONS IN PETROLEUM INDUSTRY

Thermal cracking – Catalytic cracking – Catalytic reforming – Polymerisation – Alkylation – Isomerization – Production of ethylene, acetylene and propylene from petroleum.

3. CHEMICALS FROM PETROLEUM PRODUCTS

Chemicals from petroleum – Methane derivatives – Acetylene derivatives – Ethylene derivatives – Propylene derivatives – Other products.

4. MEASUREMENTS IN PETROCHEMICAL INDUSTRY

Parameters to be measured in refinery and petrochemical industry – Selection and maintenance of measuring instruments – Intrinsic safety of Instruments.

5. CONTROL LOOPS IN PETROCHEMICAL INDUSTRY

Process control in refinery and petrochemical industry – Control of distillation column – Control of catalytic crackers and pyrolysis unit – Automatic control of polyethylene production – Control of vinyl chloride and PVC production.

TEXT BOOKS

1. A.L. Waddams, ‘Chemicals from Petroleum’, Butter and Janner Ltd., 1968.
2. J.G. Balchan. and K.I. Mumme, ‘Process Control Structures and Applications’, Van Nostrand Reinhold Company, New York, 1988.

REFERENCE BOOKS

1. Austin G.T. Shreeves, ‘Chemical Process Industries’, McGraw Hill International Student edition, Singapore, 1985.
2. B.G Liptak, ‘Instrumentation in Process Industries’, Chilton Book Company, 1994.