

M204 AGRI INSTRUMENTATION & CONTROL

L T P C

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Aim :

The course aims at providing the student with a better understanding of Digital Process Control and Automation techniques using Programmable Logic Controllers /Distributed Control Systems for applications pertaining to Industrial Automation . Case studies of process industries like Paper,Sugar Dairy are studied

Objective :

To discuss the architecture of an industrial automation process
To enable the student to gain experience in data acquisition and instrument control
To give an overview of the Industrial data communications systems
To provide a fundamental understanding of common principles, various standards, protocols
To make the student become competent in using state-of-the-art VI tools.

Outcome of the Course :

After undergoing this course, students will be able to:
Select and use most appropriate technologies and standards for a given application
To develop software programs called VI
To demonstrate the principles of ladder logic/SCADA interface programming.

Theory

Review of computers in process control: Data loggers, Data Acquisition systems (DAS) , Direct Digital Control (DDC). Supervisory control and data acquisition systems(SCADA), sampling considerations. Functional block diagram of computer control systems. Alarms, interrupts.

Programmable logic controller (PLC) basics: Definition, overview of PLC systems, input/output modules, power supplies , isolators, general PLC programming procedures, functions: Register basics, timer functions, counter functions.

Virtual Instrumentation: Historical perspective , advantages, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming . Development of virtual instrument using GUI, Real-time systems.

Industrial communication systems:

Interface: Introduction, principles of interface, serial interface and its standards. Parallel interfaces and buses.

Field bus: Use of field buses in industrial plants, functions, international standards, performance, use of Ethernet networks, field bus advantages and disadvantages. Field bus design , installation , economics and documentation.

Instrumentation network design and upgrade : Instrumentation design goals, cost optical and accurate sensor networks. Global system architectures, advantages and limitations of open networks, HART network and Foundation field bus network.

Profibus –PA : Basics, architecture , model , network design and system configuration. Designing PROFIBUS-PA and Foundation field bus segments : general consideration ,network design.

Application of PC based instrumentation and control systems for:

Green House: History of modeling and control of green house, Importance mathematical modeling of green house, identification of control and manipulation variables for green house, development of mathematical model based on identified variables for green house, control systems for green house climate and soil nutrients control.

Crop Preservation : Importance of Preservation of various commodities and part of the plants. Drying processes for preservation . Mathematical relations governing drying, process , Applicability of mathematical relations in electronic control system for drying process. Variable identification for drying process, Generalized drying system concepts. Importance of grape drying systems in Indian context. , Electronic control systems for grape drying process.

Dairy, Sugar and paper industry: Study of overall processing concepts of individual industry and process steps study, study of variables characterizing various process steps and their identification , electronic automatic control systems for various process steps related to these industries.

Lab session:

Modelling of green house and controller design using model developed, controlling green house parameters using online measurement and control system. Complete design , analysis K_i , K_p , K_c , T_i , T_d sampling rate.

Learning Lab view: Introduction to lab VIEW , front panel , block diagram, Menus, palettes, VI & sub VI, Editing & Debugging VI, structures , Arrays , clusters, Charts & Graphs , Data acquisition , signal generation & processing examples.

Text Books:

1. John . W. Webb Ronald A Reis, Programmable Logic Controllers- Principles and applications, Third edition , prentice Hall Inc. New Jersey,1995.
2. Lukcas M.P. Distributed Control systems, Van No strand Reinhold co., New York, 1986.
3. Gray Johnson, Lab VIEW Graphical Programming , second edition, McGraw Hill, New York, 1997.
4. Lisa K.wells& Jeffrey Travis, Lab VIEW for everyone, prentice Hall, New Jersey, 1997.
5. Romilly Bowden, HART communication protocol, (fisher-Rosemount).
6. User Manuals of foundation field bus, profibus, Modbus, Ethernet, Device net, control net.

References:

1. Deshpande P.B. and Ash R.H , Elements of process control applications, ISA press, New York,1995

2. Noltingk B.E., Instrumentation Reference Book, 2ndEdition , Butterworth Heinemann, 1995.