



INDUSTRIAL AUTOMATION AND CONTROL

PROF. ALOKKANTI DEB

Department of Electrical Engineering,
IIT Kharagpur

PRE-REQUISITES : Electrical Networks, Control Systems

INTENDED AUDIENCE : Any interested student

INDUSTRIES APPLICABLE TO : All Process Control (Oil and Gas, Chemical), Manufacturing (Machine tools, Textile) etc.

COURSE OUTLINE :

This course provides an overall exposure to the technology of Industrial Automation and Control as widely seen in factories of all types both for discrete and continuous manufacturing. The course, in 52 lectures, discusses a wide range of related topics from the advantage and architecture of automation systems, measurement systems including sensors and signal conditioning, discrete and continuous variable control systems, hydraulic, pneumatic and electric actuators, industrial communication and embedded computing and CNC Machines. A student of IIT Kharagpur once commented - “because of the course I can identify and relate to much of the equipment that I see in a factory”.

ABOUT INSTRUCTOR :

Prof. Alok Kanti Deb received the B.E. (Hons) degree in Electrical Engineering from the Bengal Engineering College, Calcutta University, Howrah, India, and the M.Tech. (Control Engg. and Instrumentation) and Ph.D degrees in electrical engineering from IIT Delhi, Delhi., India in 1994, 1999 and 2006 respectively. He is currently a Professor with the Department of Electrical Engineering, IIT Kharagpur, Kharagpur, India. His has taught several UG and PG courses and instructed their associated labs, sessionals and seminars in the Electrical Engineering Department like, Electrical Technology, Embedded Systems, Control System Engineering, Estimation of Signals and Systems, Intelligent Control, Industrial Automation and Control, Control Theory and Digital Signal Processing. He has also taught several interdisciplinary courses like Instrumentation and Control (SMST) and Automation and Control (Steel Technology Center). His research interests include control systems, computational intelligence and automotive diagnostics. He has completed research projects with General Motors, USA and Department of Electronics and Information Technology (DeITY), Govt of India. He is presently involved in research projects with Ministry of Human Resource Development (MHRD), Aeronautical Development Agency (ADA), Bangalore, India, Ministry of Railways, Govt of India and UK India Collaboration in Smart Grids and Energy Storage.

He is a mentor to the Kharagpur Robo Soccer Students' Group (KRSSG). He was the Co-ordinator of the workshops, "Embedded and Reconfigurable Computing for Control and Signal Processing & Xilinx Embedded Design flow using Zynq and Vivado Design suite", ATDC, IIT Kharagpur, Jan 6-10, 2014 and "Estimation and Control: Advanced Theory and Applications", Dept of Electrical Engg., IIT Kharagpur, Dec 25-30, 2009. He was a organizing committee member of ICIIS-2008 & ICPS2009 at IIT Kharagpur. He is the Chair, IEEE Control System Society, IEEE Kharagpur Section.

He was an Assistant Professor with the Centre for Soft Computing Research, Indian Statistical Institute, Kolkata, India from 2005 to 2007. He served as an Engineer with Calcutta Electric Supply Corporation Ltd., Kolkata, from 1994 to 1997, and was involved in commissioning, maintenance and condition monitoring of turbine-generator sets of various ratings.

Prof. Deb received the Student Travel Award from the IEEE Neural Network Society for attending the IEEE World Congress on Computational Intelligence in 2002. He also received Travel Award from the IEEE Computational Intelligence Society in 2014 to attend IEEE Symposium Series on Computational Intelligence (SSCI-2014). He has published several papers in international journals and international conferences, 1 book chapter and co-authored the book, "Industrial Instrumentation, Control and Automation", published by Jaico, Mumbai, 2013. He is the holder of the patent, "STATE ESTIMATION, DIAGNOSIS AND CONTROL USING EQUIVALENT TIME SAMPLING" (US Patent No. – 8,751,097 B2, dt, June 10, 2014). He regularly reviews papers from several journals and conferences.

COURSE PLAN:

Module I

- Introduction
- Introduction(Cont.)
- Architecture of Industrial Automation Systems
- Architecture of Industrial Automation Systems(Cont.)

Module II

- Measurement Systems Characteristics
- Measurement Systems Characteristics(Cont.)
- Data Acquisition Systems
- Data Acquisition Systems(Cont.)

Module III

- Introduction to Automatic Control
- Introduction to Automatic Control(Cont.)
- P-I-D Control
- P-I-D Control(Cont.)
- PID Control Tuning
- PID Control Tuning(Cont.)
- Feedforward Control Ratio Control
- Feedforward Control Ratio Control(Cont.)
- Time Delay Systems and Inverse Response Systems
- Time Delay Systems and Inverse Response Systems(Cont.)
- Special Control Structures
- Special Control Structures(Cont.)
- Concluding Lesson on Process Control (Self-study)
- Introduction to Sequence Control, PLC , RLL
- Introduction to Sequence Control, PLC , RLL(Cont.)
- Sequence Control. Scan Cycle, Simple RLL Programs
- Sequence Control. Scan Cycle, Simple RLL Programs(Cont.)
- Sequence Control. More RLL Elements, RLL Syntax
- Sequence Control. More RLL Elements, RLL Syntax(Cont.)
- A Structured Design Approach to Sequence Control
- A Structured Design Approach to Sequence Control(Cont.)
- PLC Hardware Environment
- PLC Hardware Environment(Cont.)

Module IV

- Flow Control Valves
- Flow Control Valves(Cont.)
- Hydraulic Control Systems - I
- Hydraulic Control Systems - I(Cont.)
- Hydraulic Control Systems - II
- Hydraulic Control Systems - II(Cont.)
- Industrial Hydraulic Circuit
- Industrial Hydraulic Circuit(Cont.)
- Pneumatic Control Systems - I
- Pneumatic Control Systems - I(Cont.)
- Pneumatic Systems - II
- Pneumatic Systems - II(Cont.)
- Energy Savings with Variable Speed Drives
- Energy Savings with Variable Speed Drives(Cont.)
- Introduction To CNC Machines
- Introduction To CNC Machines(Cont.)

Module V

- The Fieldbus Network - I
- The Fieldbus Network - I(Cont.)
- Higher Level Automation Systems
- Higher Level Automation Systems(Cont.)
- Course Review and Conclusion (Self-study)