Course code	Course name	L-T-P-Credits	Year of Introduction
AE401	LOGIC & DISTRIBUTED CONTROL SYSTEM	4-0-0-4	2016

Prerequisite: AE301 Control system

Course objectives

- To give an introductory knowledge about PLC and the programming languages.
- To give basic knowledge in the architecture and local control unit of distributed contr ol system.
- To give adequate information in the interfaces used in DCS.
- To give basic knowledge about Computer Controlled Systems.

Syllabus

Programmable Logic Controller - Architecture of PLC - Design of PLC - PLC Basic Functions - Applications Of PLC - Instructions in PLC - PLC programming methods as per IEC 61131 – SCADA - Distributed Control System - Architectures - Interfaces In DCS - Process Safety & Safety Management System - Risk Terminologies - Instrumented System.

Expected outcome

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

i. Understand the basics of PLC and PLC Programming
ii. Know the whereabouts of implementation of SCADA
iii. Reproduce the working of Distributed Control System
iv. Perform the implementation of DCS
v. Recognise the safety procedures to be maintained in an industry

Text Books

1. John. W. Webb Ronald A Reis - Programmable Logic Controllers - Principles and Applications, Fourth edition, Prentice Hall Inc., New Jersey, 1998.
2. Michael P. Lukas, 'Distributed Control Systems', Van Nostrand Reinhold Co.,Canada,1986
3. Petruzella, 'Industrial Electronics', McGraw Hill, Second edition, 1997.

Reference Books

1. Krishna Kant – Computer based Industrial Control, Prentice Hall, New Delhi, 1997.
2. Thomas A. Hughes, 'Programmable Logic Controllers', ISA press,2007.

Course Plan

Module	Contents	Hours	Semester Exam Marks
I	Programmable Logic Controller : Evolution of PLC's, Components of PLC, Advantages over relay logic, Architecture of PLC, Programming devices, Discrete and Analog I/O modules, Programming languages, Ladder diagram, Programming timers and counters, Design of PLC, Definition of PLC, , overview of PLC systems, input/output modules, power supplies, isolators. General PLC programming procedures, programming on-off inputs/ outputs. Auxiliary commands and functions: PLC Basic Functions: Register basics, timer functions, counter functions.	9	15%
II	Applications Of PLC : Instructions in PLC	9	15%

	Program control instructions, math instructions, sequencer instructions, Use of PCas PLC, Application of PLC, Case study of bottle filling system, PLC programming methods as per IEC 61131, Developing programs using Sequential Function Chart, Functional Block Diagram, Analog control using PLC (PID controller configuration), Interfacing PLC to SCADA/DCS using communication link (RS232, RS485) , Protocols (Modbus ASCII/RTU) and OPC, Development stages involved for PLC based automation systems.		
FIRST INTERNAL EXAMINATION			
III	Computer Controlled Systems: Basic building blocks of Computer controlled systems, SCADA, Data Acquisition System, Supervisory Control, Direct digital Control.	7	15%
IV	Distributed Control System : DCS - Architectures, Comparison, Local control unit, Process interfacing issues, Communication facilities. Distributed Control System Basics: DCS introduction, Various function Blocks, DCS components/block diagram, DCS Architecture of different makes, comparison of these architectures with automation pyramid, DCS specification, latest trend and developments, DCS support to Enterprise Resources Planning (ERP), performance criteria for DCS and other automation tools.	10	15%
SECOND INTERNAL EXAMINATION			
V	Interfaces In Dcs : Operator interfaces, Low level and high level operator interfaces, Operator displays, Engineering interfaces, Low level and high level engineering interfaces, General purpose computers in DCS, DCS detail Engineering, configuration and programming, functions including database management, reporting, alarm management, diagnosis.	9	20%
VI	Process Safety & Safety Management System : Process safety and Safety Management Systems: Introduction to process safety, risk, risk terminologies, consequence and risk, risk measurement, Process Hazard Analysis (PHA), Hazard and operability study (HaZOp), Safety Integrity Level (SIL), Introduction to IEC61511 standard for Functional safety, protection layers, Safety Instrumented System:	10	20%

	function, architecture, safety life cycle, Application of safety system.		
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN

Maximum Marks:100 Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Modules 1 and 2 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part B

Answer any two out of three questions uniformly covering Modules 3 and 4 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Modules 5 and 6 together. Each question carries 15 marks and may have not more than four sub divisions.

(20 x 2 = 40 marks)