Shram Sadhana Bombay Trust's
College of Engineering & Technology, Bambhori, Jalgaon
Syllabus for Certificate Course in "Industrial Automation and Robotics "

Paper-I: Industrial Process Parameters Measurement and Monitoring

(Total 90 Hrs)

1) Introduction to basic Electronics and Electrical concept (15 Hrs)

Basic Electronics, Devices And Circuits- Semiconductor Physics, Diode, Capacitor, Inductor, Bipolar-Transistors, FET, Transistor Biasing Circuits, transistor as switch. Amplifiers, Oscillators, Wave Shaping Circuits, Multivibrator Circuits and Operational Amplifiers and their Applications.

Rectifier, filter, regulator, Power supply, Cables, connectors, switches and relay. Voltage and Current Sources, EMI, Batteries.

Electronic Instruments And Measurement: (15 Hrs)

Basics of Measurements and use of multimeter, CRO, DSO, Signal Generators etc.

Digital Electronics**:** Difference between analog and digital signal. Number System , Codes and Parity, Logic Gates and Families , Logic Simplification, Arithmetic circuits, Decoders, Multiplexers and De-Multiplexers, Latches and flip flops, Shift Register, Counters, A/D and D/A converters.

2) Introduction to Industrial Automation (15 Hrs)

Definition and fundamentals of automation, reasons for Automating, basic elements of an automated system: Power, Program and control system.

Advanced automation functions: safety, maintenance & repair diagnosis, error detection and recovery

Levels of automation Automation principles and strategies: USA principle, ten strategies of automation and production system, automation migration strategy

3) Industrial Process Sensors and Measurement (25 Hrs)

Generalised Data Acquisation system, Signal conditioning, Transducers, Introduction to various Sensors, Temperature, Pressure, Flow, Displacement, Speed Level, Humidity, Ph value etc

Optical, Inductive, Capacitive, Encoders, RTD, Ultrasonic, Thermocouples, Rotameters, Accelerometers, Viscosity, Measuring gauges, Demonstrate Proper Wiring Techniques and Practical Applications.

Flow Meters – Area flow, Mass Flow & Quantity, Errors & calibration. Control Devices - Solenoid Valves, Control valves, Introduction to Actuators, Pumps & Motors, Electrical Drives, Relays & Contactors.

Concept of Intrinsic safety, Zener Barriers, Signal isolators, Signal Multipliers, Signal Converters.

4) **Introduction to Process Control** (10 Hrs)

Proportional Controllers, Integral Controllers, Derivative Controllers, Controller Tuning.

Introduction to Measuring & Indicating Instruments (10 Hrs)

Digital indicators, Bar Graph Indicators, Analog indicators, Indicating Controllers, Pen Recorders, Chartless Recorders, Indicating lamps & Meters, Alarm Annunciations.

Reference Books:

1. Krishna Kant, " Computer-Based Industrial Control", 2nd Revised edition, PHI publication.
2. Frank Lamb, " Industrial Automation Hands-On", 2013, McGraw-Hill Education.
3. Stamatios Manesis, George Nikolakopoulos, " Introduction to Industrial Automation", CRC.
4. R. P. Jain, "Modern Digital Electronics" McGraw Hill Education (India) Private Limited, Fourth Edition, 2017.
5. A.P. Malvino, "Electronics Principles" TMH Publications.
6. R. S. Sedha, "Applied Electronics", S. Chand Publication.
7. V.K. Mehta, "Principles of Electronics", S. Chand Publications.
8. H.s. Kalsi, "Electronics Instrumentation", The McGrew Hill Companies Second Edition.

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Paper-II: Programmable Controllers for Robots and Industrial Application

(Total 90 Hrs)

1. Introduction to Microprocessor and Microcontroller (20 Hrs)

Microprocessor Evolution Tree, Microprocessor Architecture (Harward & Princeton), General Architecture of the Microprocessor and its operations, Component of Microprocessor system: Processor, Buses, Memory, Inputs-outputs (I/Os) and other Interfacing devices.

Evolution of microcontrollers, Comparison of different microcontrollers such as Intel 8051/PIC/At mega 16 & ARM other hardware Ardunio and Raspberry-PI. Comparison of Microprocessor and Microcontroller, Definition of Embedded system, Types of architectures - Harvard and Von-neuman, RISC architecture.
Selection factors of microcontroller (Architecture type, speed, Word size, instruction set, memory, and I/O capability).

2. Study of Controller Architecture and Programming (20 Hrs)

Block diagram description of 8051, Register in 8051,PSW,ROM memory map, RAM memory space allocation, Register Banks 8051 pin diagram, Understanding the function of each pin, port structure, Dual roles and I/O port programming
Ardunio Programming Basics.

3. Study of Interfacing of Peripheral and Programming (20 Hrs)

Sensors & Actuators Sensors: Selection of sensors (Displacement, temperature, acceleration, force /pressure) based on static and dynamic characteristics

Interfacing: Concept of interfacing, bit accuracy and sampling speed, amplifying electronics, Memory Interfacing and I/O interfacing – Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

Actuators: Principle and selection of mechano-electrical actuators (1) DC motors (2) Stepper Motors (3) Solenoid Actuators (4) Servo Motors (5) BLDC.

4. Programmable Logic Controller (20 Hrs)

Introduction about Programmable Logic Controller, History of PLC, Architecture of PLC, CPU, IO Modules, Power Supply and Communications, Input and Output Devices, Need of PLC for Industrial Automation, Types of PLC Models,

Introduction about PLC Programming, Types of Programming Languages, Introduction about PLC Programming software, Ladder logic diagram, Structure of program, Procedure for creating ladder diagram, Logical function done by ladder program in software, Interfacing the field component to PLC, Sink and Source type wiring, Need of push button for industrial automation, Importance of latching and unlatching concepts, Memory concept

5. Robots and their applications: (10 Hrs)

Introduction to robots, Types, Classifications, Selection of robots, Robot Degrees of freedom, Robot configuration, Accuracy and repeatability, Specification of a robot, Robot feedback controls:

Point to point control and Continuous path control, Control system for robot joint, Adaptive control, Drives and transmission systems, End effectors, Industrial robot applications of robots

Reference Books:

1. 1. M.A. Mazidi, J.C. Mazidi, R.D. McKinlay, The 8051 Microcontroller and Embedded Systems using Assembly and C, Second Edition, Pearson
2. Kenneth Ayala, The 8051 Microcontroller, Third Edition, Delmar Learning, a part of Cengage Learning (India Edition)
3. Ajay Deshmukh, Microcontrollers[Theory and Applications], Tata McGraw hill, New Delhi
4. Mike Predko - Programming and Customizing 8051 micro controller, TMH.

5. Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar, PENRAM International Publishers.

6.Programmable Logic Controllers by W.Bolton
7. Introduction to Programmable Logic Controllers by Garry Dunning, 2nd edition, Thomson, ISBN:981-240-625-5
8.Programmable Logic Controllers by Hugh Jack.

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Paper-III: Subject Project and Practical **(Total 120 Hrs)**

Subject Project & Practical: (**120 Hrs)**

Students have to prepare and submit the Project Report individually based on Industrial Real Time / Industry Automation / any Problem Solving project with consultation and guidance of internal guide of the Institute/ College.

CERTIFICATE COURSE IN INDUSTRIAL AUTOMATION AND ROBOTICS

Objectives:-

1. Understand the fundamentals Programmable Controllers systems.
2. Identify the types of Microcontroller and PLC systems.
3. Design, edit, test, and document Microcontroller and PLC Programs.
4. Diagnose and troubleshoot System using software.
5. Specify safety consideration for personnel, field devices and automated equipment.

Duration of the Course : 01 Year

Structure of the Course -

Paper-I : Industrial Process Parameters Measurement and Monitoring
Paper-II : Programmable Controllers for Robots and Industrial Application
Paper-III : Subject Project and Practical

Eligibility: Students should be admitted to the college for first year degree course.

Intake : Maximum of enrolment for every course will be 60 Students.

Nature of Examination : Annual

The examination for the course will be

1) Theory Examination (External Valuation) : 60 Marks for every paper
2) Test, Tutorial, Seminar, Home Assignment, Group Discussion (External Valuation) : 40 Marks for every paper
3) Practical Examination (Project Work, Viva-Voce, Interview Tour & Lab Visit, Presentation) : 100 Marks

Credits for Certificate Course:

The course will carry 20 credits, each credit will have 15 hours of workload, out of which, and 8 credits should necessarily be assigned to practical field work / project work / training. The proof relating should be submitted during examination i.e work experience certificate / dissertation / report etc duly issued and signed by the concerned institutional authority / coordination / faculty.

Coordinator

Head
Electronics & Telecommunication Engg. Department
SSBT's College of Engineering & Technology
Bambhori,Jalgaon - 425001(M.S.)

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E&TC