PROPOSED SYLLABUS

FOR

POST GRADUATE DIPLOMA IN INDUSTRIAL AUTOMATION ENGINEERING (PGDIAE)

By

KELTRON

KERALA STATE ELECTRONICS DEVELOPMENT CORPORATION LTD.

(A Government of Kerala undertaking)

KELTRON HOUSE, VELLAYAMBALAM, THIRUVANANTHAPURAM
Post Graduate Diploma in Industrial Automation Engineering

Course Name: PGDIAE

WELCOME TO THE PGDIAE TRAINING PROGRAM

Objective of the Course : We, proudly introduce our PGDIAE (Post graduate Diploma in Industrial Automation Engineering) course package, for candidates aspiring to pursue their career in small and large scale Industrial Environments, Project Engineering Companies, System Integration Houses etc. in Design, Engineering, Project Management, Plant maintenance, Installation & Commissioning and other related areas.

This Course Programme 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 like Lift Control, Sequence Control in Industries, Traffic Light control, Control of Batch processes, Speed Control and other specific applications pertaining to Industrial Automation which vary from industry to industry. Field Instruments for the measurement of process parameters and
acquisition and digital display of the measured parameters also forms a part of this programme. Ample demonstration and workshops are conducted as part of this programme enabling the participants of this course to handle jobs independently.

**Automation Engineering?**

Automation Engineering in general enables the effective and economical operation of both production equipment and processes. Automation Engineering applications are mainly used in Power Generation as well as Process Industries like Paper, Textile, Petro-chemical and food processing and packing, for traffic signal control, in Sewage and Water treatment Plants, Power Transmission & Distribution sector etc. with Local Control, Centralized Control or Remote Control depending on the requirement of a particular Industry. Automation Engineering principles are also applied in the automation of specific Equipments/Machinery and Products for improved and uniform performance thus avoiding the possibility of human error and dependence on human skill to a considerable extent.

The concept of Automation has also found extensive application in areas like Building Automation, Security Alarm Systems, GIS based Traffic Management Systems, Automatic traction, display systems etc. Automation Engineering is a mixed discipline that requires thorough knowledge in choosing Hardware for coding the control algorithms, Sensors for measurement, control & monitoring and Drives which perform the desired action as well as software development and their applications including communication between sub-systems forming a part of the main control system.

Today an Automation Engineer should acquire the overall knowledge of a Computer professional, a Hardware Developer, a Control Engineer, and a Communication Engineer.
Annexure-2

Opportunities: Career opportunities can open up in many an area ranging from automated appliances construction, automobile industry, building materials industry environmental engineering, traffic management & maintenance, medical engineering field, power and process industries, project engineering houses, system integration houses, real time software development, communication software development etc.

Career Prospects

The following are a few distinct career opportunities which open up on successful completion of this curriculum.

- Marketing and Sales of Automation Systems and Field Instruments
- Consultancy Services for Plant and Process Automation
- Design and Engineering of Automation Systems
- Automation System maintenance in Industries
- Process maintenance
- Installation & Commissioning of Automation Systems
- Real time software development and maintenance
- Plant Administrator / Automation System Administrator
- Annual maintenance Contracts and Servicing on Turnkey basis
- Product Engineering
SCHEME OF EXAMINATION AND AWARD OF MARKS

The scheme of examination shall consist of external end examinations and internal assessments based on periodic tests, assignments and attendance in theory subjects and sessional mark in practical subjects

a) The following are the details of the Course Programme:

<table>
<thead>
<tr>
<th>Course Title</th>
<th>PGDIAE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Fee</td>
<td>Rs. 28,000/-</td>
</tr>
<tr>
<td>Course Duration</td>
<td>300 hours</td>
</tr>
<tr>
<td>Marks (Examination)</td>
<td>400</td>
</tr>
<tr>
<td>Marks (Internal Assessment)</td>
<td>200</td>
</tr>
<tr>
<td>Marks (Total)</td>
<td>600</td>
</tr>
</tbody>
</table>

ELIGIBILITY: Engineering Degree / Graduation in a relevant discipline. Students in their final year of Graduation are also eligible to apply. Post Graduate Diploma Certificate shall be issued only after completion of Graduation. However, course completion certificate shall be issued as an interim measure.
b) Subjects:

<table>
<thead>
<tr>
<th>Subject Title (Theory Papers)</th>
<th>Subject Code</th>
<th>Duration (Hours)</th>
<th>Marks (Written + Internals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement of Process Parameters</td>
<td>PGDIAE M001</td>
<td>50</td>
<td>80 + 40</td>
</tr>
<tr>
<td>Design Aspects of Industrial Automation</td>
<td>PGDIAE M002</td>
<td>30</td>
<td>80 + 40</td>
</tr>
<tr>
<td>PLC, SCADA &amp; Plant Networks</td>
<td>PGDIAE M003</td>
<td>90</td>
<td>80 + 40</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subject Title (Practical Sessions)</th>
<th>Subject Code</th>
<th>Duration (Hours)</th>
<th>Marks (Written + Internals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLC, SCADA &amp; Electrical Workshop</td>
<td>PGDIAE M004</td>
<td>100</td>
<td>80 + 40</td>
</tr>
<tr>
<td>Networking Essentials</td>
<td>PGDIAE M005</td>
<td>30</td>
<td>80 + 40</td>
</tr>
</tbody>
</table>

| Total | | 300 hours | 600 |

**Award of internal assessment marks**

In respect of practical as well as theory subjects, the award of sectional mark will be based on tests, assignments and attendance in the proportion of 45% of tests, 45% of assignments and 10% for attendance. There will be a minimum of four tests and the best three of the four taken for the final sectional marks. In the case of assignments, there will be a minimum of four assignments and the best three shall be taken into account for the final sectional marks.

The class teacher shall maintain a record of all marks awarded in respect of internal assignments and class tests.
Paper - 1

Subject Title : Measurement of Process Parameters
Subject Code : PGDIAE M001
Total Hours : 50
Total Marks : 80 (Examination) + 40 (Internal assessment)

Details of Course Content :

- Introduction to Industrial Automation & Control
- Common Process variables
  - Pressure
  - Temperature
  - Flow
  - Level
  - Humidity, Ph etc
  - Displacement & Speed
- Process Measurements
  - Introduction to Sensors
  - Measuring Principles
  - Transmitters – Pr, DP, Flow, Level, Temperature
  - RTD, Thermocouple
  - Speed Transducers
  - Rotameters
  - Accelerometers
  - Viscosity
  - Measuring gauges
  - Flow Meters – Area flow, Mass Flow & Quantity
  - Signal conditioning
  - Errors & calibration
- Introduction to Intrinsic Safety
  - Concept of Intrinsic safety
  - Zener Barriers
  - Signal isolators
  - Signal Multipliers
  - Signal Converters
Annexure-2

- Introduction to Process Control
  - Proportional Controllers
  - Integral Controllers
  - Derivative Controllers
  - Controller Tuning

- Measurement of Electrical parameters
  - Voltage, Current Transducers
  - Frequency Transducers
  - Power Transducers
  - Implementation of transducer measurements

- Overview of Control Devices
  - Solenoid Valves
  - Control valves
  - Introduction to Actuators
  - Pumps & Motors
  - Electrical Drives
  - Relays & Contactors

- Interpretation of P & ID
- Introduction to Measuring & Indicating Instruments
  - Digital indicators
  - Bar Graph Indicators
  - Analog indicators
  - Indicating Controllers
  - Pen Recorders
  - Chartless Recorders
  - Indicating lamps & Meters
  - Alarm Annunciators
Paper - 2

Subject Title : Design Aspects of Industrial Automation
Subject Code  : PGDIAE M002
Total Hours   : 30
Total Marks   : 80 (Examination) + 40 (Internal assessment)

Details of Course Content :

- Detailed study of P & ID
  - Preparation of Input / output list
  - Listing of Process Range
  - List of Instruments for Hardwired Control
  - List of Field Instruments
  - Preparation of Specification Sheets
  - Choosing of Instruments

- System Study – Examples
  - Categorization of Operations
  - Categorization of Devices
  - Deducing Alarm Limits
  - Categorization of Hard / Soft Alarms
  - Categorization of Input / output signals

- Preparation of Schemes
  - Open Loop Schemes
  - Closed Loop Schemes
  - Power Supply Distribution Schemes
  - Hardwired Control Schemes
  - Measurement Schemes
  - Marshalling Schemes
  - Interface Schemes

- Overview of Input / Output signal Ranges
  - Voltage Input / output
  - Current Input / output
  - Pulse Input
  - RTD Input
Annexure-2

- Thermocouple Input

- Power Supply Design
  - Power requirements calculation
  - Redundancy in Power supply schemes
  - Choice of Circuit Breakers – Inrush current
  - Interrogation Power Supply for Inputs / Outputs

- Panels & Control Desks
  - Buffer Termination / Marshalling Cabinets
  - Power Supply Distribution in Panels
  - Control Desks / Panels
  - PLC/DCS Panels
  - Earthing – Power, signal & Panel Earthing
  - Network Cabinets & Racks

- Preparation of Wiring Diagrams
- Identification & Tagging of cables & instruments
- Common wiring practices
- Cable schedule and choice of cables
- Mechanical Design Aspects
- Software Requirements Specifications
- Importance of Quality Control
- Installation & Commissioning
Paper - 3

Subject Title : PLC, SCADA & PLANT NETWORKS
Subject Code   : PGDIAE M003
Total Hours    : 90
Total Marks    : 80 (Examination) + 40 (Internal assessment)

Details of Course Content :

- Introduction to Programmable Logic Controllers
  - Overview, Functions & Features
  - Typical areas of Application
  - PLC vs Personal Computers
  - PLC vs Dedicated Controllers
  - Logic Contact Symbology
  - Binary & Hexadecimal conversions
  - Input / output addressing

- PLC Hardware
  - Backplane & Rack
  - Power Supply Module
  - Programmable Controller
  - Discrete Input / output Modules
  - Analog Input / output Modules
  - Special Function Input / output Modules
  - Network Interface Modules
  - Serial Communication Interface
  - Memory modules
  - Proprietary Cables & accessories
  - Redundancy - overview
  - Introduction to Remote Input / outputs

- System Configuration
  - Finalization of Input / output Module count
  - Rack Configuration
  - Power Supply Limits
  - Communication Limits
  - Input / Output allotment & addressing
  - Finalization of Derived Function Blocks
Annexure-2

- Fundamentals of PLC Programming
  
  - Configuration
  - Ladder Logic (LD)
  - Function Block Diagram (FBD)
  - Instruction List (IL)
  - Structured Text (ST)
  - Sequential Function Chart (SFC)
  - Arithmetic Functions
  - Logic Functions
  - Timers and Counters
  - Communication Instructions
  - Data Transfer Instructions
  - System Bits and Words
  - Function Blocks
  - Derived Function Blocks
  - PID Function Blocks

- PLC Programming - Implementation
  
  - Configuration of Rack
  - Configuration of Controller
  - Configuration of Network Modules
  - Configuration of Input Output Modules
  - Structuring a program
  - Creation of database
  - Programmer's console
  - Downloading / Uploading Projects
  - PLC Modes (RUN, STANDBY, MONITOR)
  - Simulation & Testing
  - Loop tuning & Parameter setting
  - On line Monitoring / debugging
  - Diagnostic features

- Distributed Control System (DCS)
  
  - Concept of DCS
  - Data Acquisition Basics
  - Data Control Basics
  - DCS Architecture
  - Proprietary Networks
  - Advantages & Limitations
  - Overview of configuration & programming
Annexure-2

- Supervisory Control & Data Acquisition (SCADA)
  - Introduction to SCADA
  - SCADA Architecture
  - Communication table for signal exchange
  - Introduction to communication protocols
  - Creation of Database
  - Interfacing with PLC
  - Operating Screens
  - Application programming
  - Simulation / RUN time
  - Alarms, Trends & Bar graphs
  - Historical Data Management

- Plant Networks
  - Introduction to LANs
  - Introduction to Serial Interfaces
  - Industrial Buses
  - Proprietary IO Buses
  - Typical Network Architecture
  - Network Cables & accessories
  - Use of Fibre Optic Cables
  - Overview of Plant Network Design
  - Networking Field Instruments
**Paper - 4**

**Subject Title** : PLC, SCADA & Electrical Workshop

**Subject Code** : PGDIAE M004

**Total Hours** : 100

**Total Marks** : 80 (Examination) + 40 (Internal assessment)

**Details of Course Content :**

- Training on Various types of PLCs
- Controlling Stepper Motor using PLC
- Simulating Two Way Switch using PLC
- Controlling Motor from 3 different Position (1 ON & 2 OFF)
- Toggle functioning of two motors using timer
- Automatic switching of pair of motors.
- Single Conveyor with counter
- Water tank level control
- Security Alarm System Controlling
- Controlling Motor direction – Forward & Reverse
- Lift Control
- Traffic Signal Control
- Automatic Door
- Controlling Solenoid valve
- Controlling Pressure
- Controlling Temperature
- Controlling Flow of liquid
Annexure-2

SCADA

- Study of SCADA software
- Programming
- Real time trends
- Historical trends
- Alarm generation
- Security
- Report generation
- Recipe management
- Communication with Excel
- Communication with PLC

DRIVES

AC Motors

- Single phase motor
- Three phase motor

Motor Starter

- DOL starter
- Star–Delta starter

Speed controls for AC induction motors

- VFD Motors
- VFD Operation
- VFD Operator Interface
- Programming of basic Drive parameters
Annexure-2

DC Motor

- DC series motor
- DC shunt motor
- H-bridge

Speed controls for DC motors

- PWM (pulse width modulation)
- Wave form of PWM

Stepper Motor

- Stepper motor drive

Servo Motors

Wiring of Electrical Circuits

- PLC Panel Board
- Electrical Panel Board
- Mini Process Plant wiring
- PLC I/O Module wiring
- Power Supply Distribution Boards
- Tagging and Ferruling
Annexure-2

**Paper - 5**

**Subject Title**: Networking Essentials  
**Subject Code**: PGDIAE M005  
**Total Hours**: 30  
**Total Marks**: 80 (Examination) + 40 (Internal assessment)

**Details of Course Content**:

- Introduction to Networking
  - TCP/IP Protocol
  - Different types of addressing system
  - Introduction to IP Address
  - Subnet Mask
  - Networking Devices
  - Networking Media
  - Introduction to workgroup
  - Introduction to domain
  - CISCO Router components
  - Static and Dynamic Routing principle
  - Concepts of Wireless Networking
  - IEEE Wireless Standards

- Configuring IP Address
- Sharing Resources
- Accessing Network resources using UNC path
- Login Process
- Domain creation
- CISCO Router Basic configuration
  - Password Protection in CISCO Routers
  - Interface Configuration
  - WAN Configuration using Serial Interfaces

- Static routing and Dynamic Routing
  - Static routing Configuration
  - RIP
  - IGRP
  - EIGRP
  - OSPF
  - DEFAULT ROUTING
- Wireless Configuration – WAP & Ad Hoc
Certification

CE-CELL – KELTRON Combined Certification

- Certification Name: Post Graduate Diploma in Industrial Automation Engineering (PGDIAE)

- It is suggested that the Certification shall be done jointly by the College and KELTRON as a token of Industrial Partnership.

- In the case of Students who complete their course while pursuing their Graduation, the PG Diploma Certificate shall be issued only after successful completion of the Graduation Programme. However, a Course completion certificate shall be issued as an interim measure.