6.1 PROGRAMMABLE LOGIC CONTROLLERS

L	P
4	3

RATIONALE

A diploma holder when employed in automated industrial process controls or in automated power station will be required to know the basics of Programmable Logic Controllers, their working and their programming. In industry, many manufacturing processes demand a sequence of operation, which are to be performed repetitively. Early automation systems were mechanical in design, timing and sequencing being effected by gears and cams. Slowly these design concepts were replaced by electrical drives which were controlled by relays and now by programmable logic controllers (PLCs). A PLC is a solid state device, designed to operate in noisy industrial environments and can perform all logic functions. PLCs are widely used in all industries for efficient control operations. A diploma holder in industry is called upon to design, modify and troubleshoot such control circuits. Looking at the industrial applications of PLCs in the modern industry, this subject finds its usefulness in the present curriculum.

DETAILED CONTENTS

1. Introduction to PLC (12 hrs)

   What is PLC, concept of PLC, Building blocks of PLC, Functions of various blocks, limitations of relays. Advantages of PLCs over electromagnetic relays. Different programming languages, PLC manufacturer etc.

2. Working of PLC (16 hrs)

   - Basic operation and principles of PLC
   - Scan Cycle
   - Memory structures, I/O structure
   - Programming terminal, power supply

3. Instruction Set (16 hrs)

   - Basic instructions like latch, master control self holding relays.
   - Timer instruction like retentive timers, resetting of timers.
   - Counter instructions like up counter, down counter, resetting of counters.
   - Arithmetic Instructions (ADD,SUB,DIV,MUL etc.)
   - MOV instruction
   - RTC(Real Time Clock Function)
   - Watch Dug Timer
   - Comparison instructions like equal, not equal, greater, greater than equal, less than, less than equal

4. Ladder Diagram Programming (10 hrs)

Programming based on basic instructions, timer, counter, and comparison instructions using ladder program.

5. Applications of PLCs (10 hrs)

- Object counter
- On-off control
- Car parking
- Sequential starting of motors
- Traffic light control
- Motor in forward and reverse direction
- Star-Delta, DOL Starters
- Filling of Bottles
- Room Automation

LIST OF PRACTICALS

PLCs

1. Components/sub-components of a PLC, Learning functions of different modules of a PLC system
2. Practical steps in programming a PLC (a) using a Hand held programmer (b) using computer interface
3. Introduction to step 5 programming language, ladder diagram concepts, instruction list syntax
4. Basic logic operations, AND, OR, NOT functions
5. Logic control systems with time response as applied to clamping operation
6. Sequence control system e.g. in lifting a device for packaging and counting
7. Use of PLC for an application(teacher may decide)

INSTRUCTIONAL STRATEGY

Introduce the subject and make the students familiar with applications of PLCs and Microcontrollers. The inputs shall start with theoretical inputs to architecture, instruction set, assembly language programming, Small projects may be identified, be designed and implemented. PLC ladder diagram and programming should be supplemented with visits to industry. More emphasis may be given to practical work.

RECOMMENDED BOOKS

1) Programmable Logic Controller by Job Dan Otter; P.H. International, Inc, USA
2) Introduction to PLCs by Gary Dunning. McGraw Hill
3) Module on PLCs and their Applications by Rajesh Kumar, NITTTR Chandigarh

4) Programmable Logic Controller and Microcontrollers by Gurpreet Kaur and SK Sahdev by Uneek Publications, Jalandhar
5) Module on "Allen Bradlag PIC (SLC 500), Institution set-1, by Rajesh Kumar, NITTTR, Chandigarh
6) Module on "PLC Applications based on SLC 5/03" By Rajesh Kumar, NITTTR Chandigarh

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1.	Introduction to PLC	12	15
2.	Working of PLC	16	30
3.	Instruction Set	16	30
4.	Ladder Diagram Programming	10	15
5.	Applications of PLCs	10	10
	Total	**64**	**100**

6.2 ADVANCED CONTROL SYSTEM

L	P
4	2

RATIONALE

This course will enable students to study in detail the different types of advanced control systems used in Instrumentation and will provide understanding of basic control loops and characteristics of various controllers. The students will appreciate the importance and limitations of process control and actual controlling aspects. Hence, this subject.

DETAILED CONTENTS

1. Multi-Loop Control System (12 hrs)

   Introduction to multi-loop control system, feed-forward, cascade, ratio, adaptive and split-range control system.

2. Tuning-Zieglar Nichols method with basic concepts excluding mathematical part. (06 hrs)

3. Non-Linear Control System (10 hrs)

   Introduction, behaviour of non-linear control system. Different types of non-linearities, saturation, friction, backlash, hysteresis, dead zone, and relay. Difference between linear and non-linear systems.

4. Computer Control System (12 hrs)

   Introduction to DDC, DCS & SCADA and their applications

5. Data acquisition System (10 hrs)
   - Introduction, Block Diagram of data acquisition system, selection criteria

6. Introduction to Artificial intelligence and Robotics (10 hrs)
   Concept of fuzzy and neuro-fuzzy logic in control systems. Introduction to Neural Networks

7. Virtual Instrumentation (04 hrs)

Note: Visits to industries such as RRL, Petrochemical, Cement Plant, Pharmaceutical etc

LIST OF PRACTICALS

1. To perform feed forward control system.
2. To perform cascade control system.
3. To perform ratio control system.
4. To perform split-range control system.
5. To perform DCS system.

6. To perform DDC system.
7. To study applications of Robotics.
8. To perform virtual instrumentation by a software such as Lab View / Flex Pro/Mat lab etc.

INSRUCTIONAL STRATEGY

Since the knowledge of this subject is required to have good grasp of the control techniques. The subject teacher is required to lay more emphasis on providing information about practical applications. The students may be given exposure to laboratory exercises and process industry and shown various controls and latest software used in the field of Instrumentation and Control.

RECOMMENDED BOOKS

1. Control System Engineering by Bhattacharya, Pearson Education, Sector 62, Noida
2. Chemical Process Control by George Stephanopolous: EEE edition, PHI Publishers, New Delhi
3. Process Control by Peter Harrot, Tata Mc Graw Hill Publishing Co. New Delhi
4. Control System by Nagrath Gopal
5. Control System: Theory and Practice by Ghosh, Pearson Education, Sector 62, Noida
6. Control Engineering by Ganesh Rao, Pearson Education, Sector 62, Noida
7. Control System by RC Shukla
8. Introduction to Fuzzi Logic by Bo-Yuan
9. PLC by Botton

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocations
1.	Multi-Loop Control System	12	20
2.	Tuning-Zieglar Nichols method with basic concepts excluding mathematical part	06	10
3.	Non-Linear Control System	10	15
4.	Computer Control System	12	20
5.	Data acquisition System	10	15
6.	Introduction to Artificial intelligence and Robotics.	10	15
7.	Virtual Instrumentation	04	05
Total		**64**	**100**

6.3 VIRTUAL INSTRUMENTATION

L	P
4	2

RATIONALE

Virtual instrumentation is one of the latest emerging techniques in the field of instrumentation. Because of its numerous advantages over traditional instruments, VI is being used in almost every field. Knowledge of this subject will enable diploma students to make them aware of hardware, software and interfacing devices and its importance in the field of instrumentation.

DETAILED CONTENTS

1. Introduction to virtual instrumentation (08 hrs)

   Historical perspective, advantages of virtual instruments over conventional/traditional instruments, block diagram and architecture of virtual instruments.

2. Learning Lab view (22 hrs)

   Introduction, Front panel, Block diagram, Menus, Palettes, VI &Sub VI, Editing and Debugging VI, Structures, Arrays, clusters, charts & Graphs, Data acquisition, Instrument control, signal processing examples

3. Data acquisition basics (20 hrs)

   ADC, D to A , DIO, connectors and timers, PC hardware structure, introduction to various Data Acquisition Cards.

4. Common instrumentation interfaces (08 hrs)

   RS232C / RS485, GPIB, USB, instrumentation buses(introduction such as inter bus).

5. Applications of VI in various fields: High Voltage, Defence, Industrial, Medical, Automotive, Nuclear Energy (06 hrs)

LIST OF PRACTICALS

1. G-programming using LAB view/flex pro.

2. - Create a simple VI consisting of a dial and a thermometer.
   - Developing VI for converting temperature in degree Centigrade to degree Fahrenheit.

3. Creation of sub-VI using above VI as sub VI to convert the temperature in degree Kelvin.

4. Application of LABVIEW / Flex Pro.
5. Simulation of Process control system using computer simulation.
6. Acquisition of signals from transducers such as temperature, acceleration or function generator using USB interface and transfer the same to PC.

RECOMMENDED BOOKS

1. LABVIEW Graphical Programming by Gary Johnson; Tata McGraw Hill Publishing Co. New Delhi
2. Basic Concepts of LABVIEW 4 by SOKO loft; PHI
3. PC Interfacing for data acquisition and Process Control by S Gupta, JP Gupta; Instrument Society of America.
4. Learning with Lab View 7 by Robert H. Bishop, Pearsn Education.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Introduction to virtual instrumentation	8	15
2.	Data flow and programming techniques	22	30
3.	Data acquisition basics	20	30
4.	Common instrumentation interfaces	8	15
5.	Applications of VI in various fields	6	10
Total		**64**	**100**

6.4 ELECTIVE II

6.4 (a) COMPUTER AIDED INSTRUMENTATION

L	T	P
4	–	2

RATIONALE

Computer aided instrumentation subject makes every student of Instrumentation and control discipline aware of present state-of-art control procedures and fully equipped with taking responsibilities in any automated/computerized control industry/process plants. In this course, the requisite knowledge of firmware and associated specialization is provided along with some hands on experience on simulation strategies.

DETAILED CONTENTS

1. Computer aided Instrumentation (6 hrs)
   - 1.1 Introduction to PC based instrumentation
   - 1.2 PC opened up and architecture
   - 1.3 General structure of PC based instrumentation
   - 1.4 Advantages and disadvantages of computer based instrumentation
   - 1.5 Comparison with other control systems
   - 1.6 Introduction to various instrumentation packages like Lab View/Flex pro etc.

2. Buses and Standards (10 hrs)
   - 2.1 Introduction
   - 2.2 BUS types
   - 2.3 The I/O BUS
     - a) ISA bus
     - b) EISA Bus
     - c) PCI bus
   - 2.4 GPIB
   - 2.5 RS-232
   - 2.6 USB

3. Virtual Instrumentation (4 hrs)
   - 3.1 Basic concepts of Virtual Instrumentation
   - 3.2 Need

4. Computers in Process Control (6 hrs)
   - 4.1 Programmable Controller
   - 4.2 Data Logging
   - 4.3 Supervisory Control

4.4 Computer based controllers.

5. Linear Circuits and Signal Conditioning (6 hrs)

5.1 Op-Amps
5.2 Instrumentation amplifiers and signal conditioning
5.3 Multiplexers and Demultiplexers
5.4 ADC and DAC

6. Parallel Port (PP) Interfacing Techniques (8 hrs)

6.1 Introduction to parallel port
6.2 Parallel port as output port
6.3 Programming of PP
6.4 Parallel port as input port and its programming

7. Serial Port (SP) Interfacing Techniques (8 hrs)

7.1 Introduction to serial port
7.2 Serial port as output port
7.3 Programming of SP
7.4 Serial port as input port and its programming

8. USB Port Interfacing Techniques (4 hrs)

8.1 Introduction to USB port
8.2 USB port as output port

9. Using Instrumentation Package like Lab. View/Flex pro etc for computer interfacing, Graphical programming (4 hrs)

10. Case Study (8 hrs)

10.1 CNC Machine controller
10.2 Power plant controller
10.3 Cement plant control
10.4 Sugar plant control
10.5 Textile plant control

LIST OF PRACTICALS

1. Controlling of relays, and devices using parallel port
2. Analog to digital conversion using ADC 804
3. Digital to analog conversion using DAC 800
4. Generation of a square wave through parallel port
5. Generation of a rectangular wave through parallel port
6. Implementing a data acquisition application using an 8-bit data acquisition card on Lab. View/Flex pro software.
7. Implementing a low pass/ high pass filters on a sample of data acquired using Lab. View/Flex pro software.
8. Data representation in line /graph/bar graph using Lab. View/Flex pro software.

9. Application of Lab. View/Flex pro software in different computer aided instrumentation situations

INSTRUCTIONAL STRATEGY

The students should be exposed to various instrumentation packages available while teaching this subject. Assignments for making small GUI and should be given to students. Exercises involving data acquisition should be taken up.

RECOMMENDED BOOKS

1. Computer Interfacing: A Practical Guide to Data Acquisition and Control by Rigby WH and T Dalby 1995; Prentice Hall Inc. Englewood Cliffs, NJ 232 pp. ISBN 0 – 13 288374 – 0
2. See also accompanying Laboratory Manual by Same title: ISBN 0 –13 – 339797-1
3. Measurement systems: Application and Design 4th Edition by Doeblin, EO, 1990; McGraw Hill Inc., NY. 960 pp. ISBN 0 – 07 – 017338 – 9
4. Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Sons, New Delhi
5. Microcomputer Control of Thermal and Mechanical systems by Stoecker, WF and PA Stoecker; Van Nostrand Reinhold, NY. 439 pp. ISBN 0 – 442 – 2-648 – 8

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Computer aided Instrumentation	6	10
2.	Buses and Standards	10	15
3.	Virtual Instrumentation	4	10
4.	Computers in Process Control	6	10
5.	Linear Circuits and Signal Conditioning	6	10
6.	Parallel Port (PP) Interfacing Techniques	8	10
7.	Serial Port (SP) Interfacing Techniques	8	15
8.	USB Port Interfacing Techniques	4	5
9.	Using Instrumentation Package like Lab. View/Daisy lab/Genie	4	5
10	Case Study	8	10

Total	**64**	**100**

Elective - II

6.4 (b) OPTO ELECTRONIC DEVICES AND THEIR APPLICATIONS

L T P
4 - 2

RATIONALE

To impart latest developments in the opto electronic devices and fiber optics in the field of measurement and instrumentation technology, this subject is included in the syllabus.

DETAILED CONTENTS

1. Fundamentals of optics (10 hrs)

   Reflection, refraction, diffraction interference, polarization, photo-electric field, dispersion

2. Optical sources (08 hrs)

   Light emitting diodes (LEDs), their structure, materials characteristics, efficiency, laser diodes, infrared and ultra-violet sources.

3. Photo-detectors (08 hrs)

   Photo-diodes, Avalanche photo-diodes, PIN diodes, LDRs and photo-conductive devices, opto-isolators.

4. Optical fibers and their applications (16 hrs)

   Principle of transmission through fiber, construction, classification and material consideration of optical fiber, mode of communication, characteristics of fibers, optical transmitters and detectors used in optical fibers, coupling, splices and connectors.

5. Lasers (10 hrs)

   Fundamentals of laser emission, types of Lasers. Use of Lasers in measurement of distance, velocity, acceleration and length, Industrial applications of Lasers.

6. Optical instruments (12 hrs)

   Light intensity meter, optical pyrometer, polari-meter, infra-red thermometer, spectro-photo meter, optical filters, beam splitters.

LIST OF PRACTICALS

1. Verification of laws of reflection in curved mirrors.
2. Measurement of refractive index and critical angle.

3. Measurement of light intensity/optical power of 1. A bulb, 2. LED, 3. Laser diode and its variation with distance.
4. Study characteristics of photo-diode detector and one of its applications (say light intensity measurement).
5. Use of photo-resistor (LDR) for controlling light sensitive switch.
6. Study and use of opto - isolation triggering an SCR/Triac.
7. Study and use of optical pyrometer for temperature measurement.
8. Measurement of distance using laser based trans-receiver.
9. Study and use of optical fiber based trans-receiver.
10. Detection of laser beam using Photodiode, Op amp. and comparator.

RECOMMENDED BOOKS

1. Optical Fiber Communication by M Senior; Prentice Hall of India, New Delhi
2. Optical Fiber Communication by J Gower; Prentice Hall of India, New Delhi
3. Optical Fiber Communication by Gerd Keiser; McGraw Hill International Editions
4. Optical Communications-Communication and Systems by JH Franz and VK Jain; Narosa Publishing House, New Delhi
5. Optical Fiber Communication Systems by GP Agrawal; John Wiley and Sons, New Delhi
6. Optical Fiber Communication and its Applications by SC Gupta; Prentice Hall of India, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Fundamentals of optics	10	10
2.	Optical sources	08	15
3.	Photo-detectors	08	10
4.	Optical fibers and their applications	16	25
5.	Lasers	10	15
6.	Optical instruments	12	25
Total		**64**	**100**

6.5 BASICS OF MANAGEMENT

L	P
3	-

RATIONALE

The diploma holders are generally expected to take up middle level managerial positions, their exposure to basic management principles is very essential. Topics like Structure of Organization, Leadership, Motivation, Ethics and Values, Customer Relationship Management (CRM), Legal Aspects of Business, Total Quality Management (TQM), Intellectual Property Rights (IPR) etc. have been included in the subject to provide elementary knowledge about these management areas.

DETAILED CONTENTS

1. Principles of Management (06 hrs)

   1.1. Introduction, definition and importance of management.
   1.2. Functions of Management

   Planning, Organizing, Staffing, Coordinating, Directing, Motivating and Controlling

   1.3. Concept and Structure of an organization
   Types of industrial organization

   a) Line organization
   b) Functional organization
   c) Line and Functional organization

   1.4. Hierarchical Management Structure

   Top, middle and lower level management

   1.5. Departmentalization

   Introduction and its advantages.

2. Work Culture (06 hrs)

   2.1 Introduction and importance of Healthy Work Culture in organization

   2.2 Components of Culture

2.3 Importance of attitude, values and behaviour , Behavioural Science – Individual and group behaviour

2.4. Professional ethics – Concept and need of Professional Ethics

3. Leadership and Motivation (06 hrs)

3.1. Leadership

a) Definition and Need of Leadership
b) Qualities of a good leader
c) Manager vs. leader

3.2. Motivation

a) Definition and characteristics of motivation
b) Factors affecting motivation
c) Maslow's Need Hierarchy Theory of Motivation

3.3. Job Satisfaction

4. Legal Aspects of Business: Introduction and need (06 hrs)

4.1. Labour Welfare Schemes

a) Wage payment : Definition and types
b) Incentives: Definition, need and types

4.2. Factory Act 1948

4.3. Minimum Wages Act 1948

5. Management Scope in different Areas (12 hrs)

5.1. Human Resource Development
a) Introduction and objective
b) Manpower Planning, recruitment and selection
c) Performance appraisal methods

5.2. Material and Store Management

a) Introduction, functions and objectives of material management

b) Purchasing: definition and procedure

c) Just in time (JIT)

5.3. Marketing and Sales

a) Introduction, importance and its functions

b) Difference between marketing and selling

c) Advertisement- print media and electronic media

d) Market-Survey and Sales promotion.

5.4. Financial Management – Introduction

a) Concept of NPV, IRR, Cost-benefit analysis

b) Elementary knowledge of Income Tax, Sale Tax, Excise duty, Custom duty, Provident Fund

5.5 Maintenance Management

a) Concept
b) Preventive Maintenance

6. Miscellaneous topics (12 hrs)

6.1. Customer Relationship Management (CRM)

a) Definition and Need

b) Types of CRM

c) Customer satisfaction

6.2. Total Quality Management (TQM)

a) Inspection and Quality Control

b) Concept of Quality Assurance

c) TQM

6.3. Intellectual Property Rights (IPR)

a) Introduction, definition and its importance
b) Infringements related to patents, copyright, trade mark

INSTRUCTIONAL STRATEGY

It is observed that the diploma holders generally take up middle level managerial positions, therefore, their exposure to basic management principles is very essential. Accordingly students may be given conceptual understanding of different functions related to management. Some of the topics may be taught using question answer, assignment or seminar method. The teacher will discuss success stories and case

studies with students, which in turn, will develop appropriate managerial qualities in the students. In addition, expert lectures may also be arranged from within the institutions or from management organizations. Appropriate extracted reading material and handouts may be provided.

RECOMMENDED BOOKS

1. Principles of Management by Philip Kotler TEE Publication
2. Principles and Practice of Management by Shyamal Bannerjee: Oxford and IBM Publishing Co, New Delhi.
3. Financial Management by MY Khan and PK Jain, Tata McGraw Hill Publishing Co., 7, West Patel Nagar , New Delhi.
4. Modern Management Techniques by SL Goel: Deep and Deep Publications Pvt Limited, Rajouri Garden, New Delhi.
5. Management by James AF Stoner, R Edward Freeman and Daniel R Gilbert Jr.: Prentice Hall of India Pvt Ltd, New Delhi.
6. Essentials of Management by H Koontz, C O' Daniel , McGraw Hill Book Company, New Delhi.
7. Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi
8. Total Quality Management by DD Sharma, Sultan Chand and Sons, New Delhi.
9. Intellectual Property Rights and the Law by Dr. GB Reddy.
10. Service Quality Standards, Sales & Marketing Department, Maruti Udyog Ltd.
11. Customer Relationship Management: A step-by-step approach, Mohamed & Sagadevan Oscar Publication, Delhi
12. Customer Relation Management, Sugandhi RK, Oscar Publication, Delhi.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr No	Topic	Time Allotted (hrs)	Marks Allotted (%)
1.	Principles of Management	06	15
2.	Work Culture	06	10
3.	Leadership and Motivation	06	15
4.	Legal Aspects of Business: Introduction and Need	06	10
5.	Management Scope in different Areas	12	25
6.	Miscellaneous Topics	12	25
Total		**48**	**100**

6.6 MAJOR PROJECT WORK

L	T	P
-	-	8

RATIONALE

Project plays an important role in the final stage of learning for assimilation of all what has been learnt till now. It also gives an opportunity to the students to show their innovation capabilities. In addition, it gives a confidence in handling different technical situations faced in the world of work. In this syllabus, topics of projects have been listed. The faculty is advised to encourage new projects to be cultivated by the students themselves.

Project work aims at developing skills in the students whereby they apply the totality of knowledge and skills gained through the course in the solution of particular problem or undertaking a project. The students have various aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The students should identify the project or give project assignment at give least two to three months in advance. The project work identified in collaboration with industry should be preferred.

The students may be given major project assignment for a period of 8 weeks at a stretch during the final semester. During this project period, concerned teacher will monitor the progress of students by paying regular visits to the industry. The students will submit a comprehensive project report (in a presentable manner, preferably typed and bound) for evaluation by the teacher/guide, an expert from industry and an external examiner.

SUGGESTED LIST OF PROJECTS

Some of the project activities are given below:

1. Controls of Thermal Power station and Cement Plant. Prepare process flow and piping and instrumentation diagram of a section. Identify their various instruments, systems and control parameters, ranges, specifications and making of each item.

2. Design and rigging up of a simple control loop for example temperature control in an oven, maintaining constant temperature in hot water tank, level control in a water tank, flow control in a pipe line, control of pressure in a pressurized vessel by injection (acid or alkali).

3. Design and making a simple on/off controller for temperature using ICs, capacitors, resistors on a printed circuit board.
4. Design an alarm annunciation scheme for motor control (trip, supply, failure, overheating) and realizing the same in a control panel using lamps.
5. Design and making a DC regulated power supply.
6. Design and fabricate a digital combination lock
7. Design and fabricate a digital frequency counter.
8. Design and fabricate a digital stop watch
9. Design and fabricate a digital timer.
10. To dismantle and lap a control valve. Assemble and test it hydraulically.
11. Design and fabricate a simple measuring instruments for temperature, pressure, flow or level
12. Design and fabricate a signal converter.
13. Design and fabricate a signal transmitter.
14. Use of PLC for DAS controls.
15. Design, construction and implementation of load cell in a given problem
16. Design and construction of pressure transducers for industrial implementation
17. ECG analyzer while taking a case
18. Spiro data analysis for a given case
19. PLCs based design and implementation for industrial control system
20. Study and analysis of a plant Digital Distribution Control (DDC)
21. Study and analysis of a plant SCADA
22. Study and analysis of automation of a cement plant,sugar plant and Regional Research Laboratory.
23. Study and analyze automation of textile/refinery
24. Study and analyze distributed control system (DCS)
25. Data acquisition and handling for industrial problems
26. Waveform Generation using 8085
27. Measurement of Certain parameters in CNC Lathe/ Milling Controller
28. Trouble shooting of industrial plant operations
29. Estimation and costing of control system design in an industrial plant
30. Production scheduling and control technology in an industrial plant instrumentation
31. Stepper motor control using 8-bit micro-controller/ microprocessor

32. 2 x 16 alphanumeric LCD interface using 8-bit micro-controller/microprocessor
33. EPROM programmer using 8051 series micro-controller/microprocessor
34. Real time clock using 8-bit micro-controller/microprocessor
35. Temperature control using 8-bit micro-controller/microprocessor
36. Draw specifications, diagrams of various equipment systems and accessories used in a process control system. Prepare cost and time estimates
37. Draw specifications, diagrams of various equipment system and accessories used in process control in the
    a) Heat exchanger
    b) Evaporator
    c) Crystalizer
    d) Ratio control
    e) Cascade control
    f) Feed forward control
    g) Distillation column
38. Simulate control operations of
    i) pressure control and compressor
    ii) Simulate control operations of temperature control
    iii) Simulate control operations of ratio control
    iv) Simulate control operations of cascade control
    v) Simulate control operations of feed forward control
39 a) To operate and control the temperature by PLC
    b) To operate and control the flow by PLC
    c) To operate and control the pressure by PLC
    d) To operate the cascade control using PLC
    e) To operate the ratio control by PLC
40. Traffic light control using microprocessor
41. Control of a conveyor belt using PLC/PC
42. Simple control of pick-and-place robot using PC/PLC

43. Water level controller using 8085/PLC
44. Alphanumeric display system using LEDs
45. Digital Pulse rate meter using photo sensor
46. Design and fabrication of a panel for control of temperature and Pressure in a boiler
47. Study of various control elements in furnace instrumentation.

Additional List

1. Automatic Data level controller using Microcontroller
2. On-Off Temperature controller/Display using Microcontroller
3. Seven segment display using Micro-controller
4. Design of real time-clock using micro-controller
5. Automatic land Rover using Micro-controller
6. Automatic land Rover Control using Mobile phone.
7. Water level control using Micro-controller
8. Water level control using Mobile phone
9. Home Lighting control system using mobile phone
10. Control of conveyor belt using PLC
11. Water level control using PLC
12. Temperature control using PLC/MC
13. Traffic light control using PLC/MC
14. Secure Door opening control MC
15. Home security system using Mobile phone/MC
16. To control flow of liquid using PLC
17. To design a display system using Micro-controller
18. To design a object counter using PLC and MC
19. Speed checker for highways
20. Line followed Robot based on MC.
21. Speed control of motor using M.C
22. Control of Railway crossing using M.C.
23. Buzzer Control using M.C.
24. Steeper motor control using MC.
25. To control a Robotic arm using MC.
26. Water purifier system
27. Inverter
28. UPS
29. Solar energy based project
30. Wind energy based project
31. Sequence control using PLC.

Note:

1. **The list is only the guideline for selecting a project, however a student is at liberty to select any other related project of his choice independently under guidance of his teacher**

2. The quality of end-product and process adopted by the students in its execution should be taken into consideration along with other parameters while evaluating the students

A suggestive criteria for assessing student performance by the external (personnel from industry) and internal (teacher) examiner is given in table below:

Sr. No.	Performance criteria	Max. Marks	Rating Scale				
			Excellent	Very Good	Good	Fair	Poor
1.	Selection of project assignment	10	10	8	6	4	2
2.	Planning and execution of considerations	10	10	8	6	4	2
3.	Quality of performance	20	20	16	12	8	4
4.	Providing solution of the problems or production of final product	20	20	16	12	8	4
5.	Sense of responsibility	10	10	8	6	4	2
6.	Self expression/communication skills	5	5	4	3	2	1
7.	Interpersonal skills/human relations	5	5	4	3	2	1
8.	Report writing skills	10	10	8	6	4	2
9.	Viva voce	10	10	8	6	4	2
Total marks		**100**	**100**	**80**	**60**	**40**	**20**

Important Notes

1. This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.
2. The criteria for evaluation of the students have been worked out for 100 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.

The teachers are free to evolve another criterion of assessment, depending upon the type of project work. It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organizations in such an exhibition. It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific industries are approached for instituting such awards.