

Module Descriptions

**Department of Electrical
and Electronic Skills**

Industrial Instrumentation and Control Skills

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and Electronic Skills**

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2009



DEGREE PLAN

Industrial Instrumentation and Control Skills (INCT)

Level 1

Sr.	Module Code	Module Name	Contact Hours
1	IELT114	Electrical Circuits	88
2	IELT115	Electronic Circuits	88
3	INCT113	Control Valves Operation and Maintenance	64
4	ENGC102	English Communication 1	24
TOTAL HOURS			264

Level 2

Sr.	Module Code	Module Name	Contact Hours
1	INCT214	Principles of Instrumentation	88
2	INCT215	Principles of Control	88
3	INCT216	Instrumentation Skills Practice 1	64
4	ENGC203	English Communication 2	24
TOTAL HOURS			264

Level 3

Sr.	Module Code	Module Name	Contact Hours
1	INCT317	Instrumentation Calibration and Maintenance	88
2	INCT318	Distributed Control System Operation (DCS)	88
3	INCT319	Piping and Instrumentation Diagrams Reading	64
4	TRWT304	Technical Report Writing 1	24
TOTAL HOURS			264

Level 4

Sr.	Module Code	Module Name	Contact Hours
1	INCT420	Electronic Instrumentation	88
2	INCT421	PLC Programming and Interfacing	88
3	INCT422	Instrumentation Skills Practice 2	64
5	TRWT405	Technical Report Writing 2	24
TOTAL HOURS			264

Coop (15 Weeks)

Sr.	Module Code	Module Name	Equivalent Contact Hours
1	INCT523	Cooperative Training Program	128

Prerequisite —

Level 1

Contact Hours: 88

Module Description

This module covers electrical quantities, units, type of connections and their characteristics, different laws and concepts, applications for DC and AC power supply, measures current and voltage, calculates power and percent error.

Objectives

This module provides:

- Understanding of the electrical quantities.
- Skills of circuits analyzing and calculation.
- Skills of connecting circuits with different power supplies.

Learning Outcomes

After completing this module the students:

- Can connect any circuit safely.
- Deal with any power supply.
- Calculate the voltage & current passing through the circuit.

Contents

- Basic Electrical Quantities.
- DC Circuits.
- AC Circuits.
- Three Phase Circuits.

Pacing Schedule

Contact Hours	Contents	Skills Gained
6	Basic Electrical Quantities	Using Multimeter for proper measurements and accuracy
	Introduction to electrical circuit & safety	
	Basic electrical quantities	
6	Lab equipments	
	Multimeters	
	Measurement and accuracy	
6	Digital & Analogue Multimeters	
	DC Circuits	Using different rules to calculate the DC electrical quantities
	Ohm's law	
DC circuit (series , parallel)		
6	Series parallel combined connection	
	Kirchhoff's voltage & current laws	
10	Voltage divider rule	
	Current divider rule	
	Power & energy	
6	Capacitor	Understanding the characteristics of capacitor & inductor with the use of oscilloscope
	Capacitor in (series , parallel)	
6	Inductor	
	Inductance in (series , parallel)	
	Relay	
6	Oscilloscope	
	Measuring frequency & voltage	
6	AC Circuits	Knowing the difference between AC & DC supplies and the effect of different loads
	Capacitor in AC	
12	Inductor in AC	
	RL circuit	
	RC circuit	
	Impedance	
	Transformers	
6	Three Phase Circuits	Understanding the three phase connections, load calculations and the effects of balance & unbalance loads
	Star connection	
6	Delta connection	
	Star load (balance & unbalance)	
	Delta load (balance & unbalance)	
6	Revisions	

Reference:
Electrical Circuits (In House).

Prerequisite —

Level 1

Contact Hours: 88

Module Description This module covers Analog Electronics (diodes, transistors, thyristors) and Digital Electronics (logic gates, Flip Flops, coders, adders).

Objectives This module provides

- Understanding the properties of Electronic components.
- Skills of testing different types of Electronic components.
- Skills of connecting circuits of different Electronic components.

Learning Outcomes After completing this module the student

- Can differentiate between Analog and Digital Electronic circuits.
- Can test the different types of electronics component.
- Can connect the circuits with different types of electronics component.

Contents

- Introduction to Electronics & Diodes.
- Transistors.
- Thyristors.
- Digital Electronics.

Pacing Schedule

Contact Hours	Contents	Skills Gained	
6	Introduction to Electronics & Diodes	Understanding the properties of semi- conductive material, testing, different types of diode, characteristics and its applications	
	Digital and Analog Signals		
	Semiconductor principles		
6	Diodes		
	Types of diodes		
	Testing diode		
6	The PN junction diode in DC circuit		
	The PN junction diode in AC circuit (half wave rectifier)		
6	The PN junction diode in AC circuit (full wave rectifier)		
	The PN junction diode in AC circuit (full wave rectifier with smoothing capacitor)		
12	Zener diode		
	Light Emitting Diode (LED)		
	Photo Diode		
6	Transistors		Testing different types of Thyristors, applications and its properties.
	Types of Transistors		
	Testing Transistors		
	Bipolar junction Transistor (BJT)		
6	Field Effect Transistor (FET)		
	Metal oxide Field Effect Transistor (MOSFET)		
6	Thyristors	Testing different types of Thyristors, applications and its properties.	
	Types of thyristor		
	Testing thyristor		
	SCR		
6	TRIAC		
	DIAC		
12	Digital Electronics	Connecting the circuits using logic gates and finding the truth table & timing analysis	
	Decimal System , Binary System and BCD		
	Converting between numbering systems		
6	Logic Gates		
	Truth tables		
4	Timing Analysis		
	Binary Arithmetic (half & full Adder)		
6	Encoder & Decoder		
	RS & D & JK Flip Flop		

Reference:
Electronics Circuit (In House)

Prerequisite —

Level 1

Contact Hours: 64

Module Description The module covers the Operation, Maintenance and Servicing on various types of pneumatic and electro-pneumatic Control Valves which are widely used in the Process Industry.

Objectives The objectives of this module are to teach students about:

- Control Valve and why it is called a Final control element.
- ON-OFF valve.
- How Control Valves are connected in process loop.
- Operation & Maintenance of different types of Control Valves.
- Different types of pneumatic & electro-pneumatic Actuators and Positioners.

Learning Outcomes This module will make students learn about:

- Checking operations of various types of Control Valves.
- Performing maintenance of different types of Control Valves.
- Performing calibration of pneumatic & electro-pneumatic Positioners.
- Methods of Actuation.
- Servicing of Valves.
- Valve Performance.

Contents

- Introduction.
- Types of control valves
- Three-Port control valves
- Valve characteristics and parts
- Actuators & Positioners
- Electrical control valves
- Calibration and servicing

Pacing Schedule

Contact Hours	Contents	Skills Gained
6	Introduction	RT395 trainer unit operation
	Introduction to control valves	
	Familiarization with control valve testing station (RT395)	
12	Types of Control Valves	Get familiar with different types of valves
	Two-port control valves	
	Gate control valves	
	Globe control valves	
	Rotary control valves	
	Ball control valves	
	Butterfly control valves	
6	Three-Port Control Valves	Learn about three-port valves
	Mixing type three-port control valves	
	Diverting type three-port control valves	
	Piston type three-port control valves	
6	Valve Characteristics and Parts	Learn about valves characteristics and parts
	Characteristics of different types of valves	
	Parts of different types of control valves	
	Relief valves and safety valves	
12	Actuators & Positioners	Get familiar with different types of actuators and positioners
	Introduction of Actuators	
	Introduction of Positioners	
	Actions of Control Valves	
	Operating modes	
	Valves symbols	
10	Electrical Control Valves	Learn about electrically operated control valves
	Motorized actuators of control valves	
	Electro-pneumatic actuators control valves	
	Solenoid valves	
12	Calibration and Servicing	Servicing control valves
	Testing different types of control valves	
	Disassembling and assembling of different types of control valves	
	Calibrating different types of control valves	

Reference:

Control Valves Operation and Maintenance (In-house)

Prerequisite **BSEL 406**Level **1**Contact Hours: **24****Module Description**

English Communication 1 is a module for level 1 students of specialization program, as part of the English communicative competence requirement for their diploma. The module is built around a communicative competency-based program that focuses on general English language skills and workplace competencies.

Objectives

- To help students build on and enhance EL proficiency achieved at level 4 of BSEL 406.
- To help them achieve target language competencies required at work.
- To help them learn and practice the same competencies for job success.

Learning Outcomes

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

- Illustrate points and express preferences.
- Listen to and speak about job safety and team work.
- Participate effectively in meetings.
- Tell about cause and effect.
- Express disapproval, make counter-argument, conclude, compare and contrast statements

Contents

- Understanding Company Benefits
- Employees' Rights
- Job Safety
- Teamwork
- Meetings and Minutes
- Tools and Supplies
- Unions and Employment Contracts
- Using Business Machines
- Self-Employment

Pacing Schedule

Contact Hours	Contents	Skills Gained
3	Understanding Company Benefits	Illustrating points and express preferences using appropriate words and phrases
3	Employees' Rights	Describing events chronologically and telling about past situations using past perfect tense
Quiz 1		
3	Job Safety	Predicting consequences using past simple present and past
3	Teamwork	Telling about tasks and predicting consequences using causative verbs
Midterm		
3	Meetings and Minutes	Expressing indifference and disapproval and indicating order and sequence using unreal conditional with 'would' and 'could'
3	Tools and Supplies & Unions and Employment Contracts	Persuading and explaining using 'could have', 'would have' and 'however'
Quiz 2		
3	Using Business Machines	Talking about the future and inferring using passive simple future
3	Self-employment	Concluding, comparing and contrasting using 'might have', 'as---as'.
Final Examination		

Reference: Put English to Work , Level 5 by Sandra Linn

Prerequisite —

Level **2**Contact Hours: **88****Module Description**

The module concentrates on hands-on practice that expands basic understanding of measurement and control. During this module students will cover the basic tools, controls components, equipment familiarization and testing procedures.

Objectives

This module provides opportunity for the students to practice:

- Proper operation and use of test equipments.
- Principles of industrial measurement devices.
- Connect and operate various measurement devices.

Learning Outcomes

After completing this module the students will be able to :

- Operate test equipments, including: Calibrators, Multimeter, Oscilloscope, Function Generator and Power Supplies.
- Study about Control Devices.
- Learn about passive & active sensors for Temperature, Pressure, Level & Flow.
- Connection of Pneumatic & Electro-Pneumatic Transmitters & Converters.
- Working with Control Switches.

Contents

- Measurements.
- Converters and Transmitters.
- Sensors and Switches.

Pacing Schedule

Contact Hours	Contents	Skills Gained
30	Measurements	Measurement Techniques & Control devices connection
	Units of measurement ,Types of Errors & Terminology	
	Electrical Measurements	
	Multimeters	
	Oscilloscope	
	Function Generator	
	Solenoids, Control Relays	
	Timers (ON delay, OFF delay & Sequential)	
	Pressure Measurement	
	Pneumatic Pressure Transmitter	
28	Converters and Transmitters	Working with Transmitters & Converters
	Current-to-pneumatic converter	
	Pneumatic Transmitters	
	Electronic Transmitters	
	Temperature Measurement	
	Dry Block calibrator	
Temperature sensors (Thermocouple, RTD , Thermistor)		
30	Sensors and Switches	Practical's on Process Sensors & Switches
	Flow measurement	
	Orifice plate, Venturi tube, Pitot tube	
	Level Measurement	
	Level sensors	
	Temperature switches	
	Pressure Switches	
	Limit Switches	

Reference:

Principles of Instrumentation (In-house)

Prerequisite —

Level 2

Contact Hours: 88

Module Description

This module combines knowledge with hands on experience which enables students to learn the necessary skills and deals with elements of process control, transfer functions, control system evaluation, characteristics of process dynamics & controller principles.

Objectives

This module provides:

- Opportunity for the students to practice skills similar to what he will find in the actual field of work.
- It covers the four most common parameters in the process plant like temperature, level, pressure and flow.
- The students will do troubleshooting and maintenance for the failed process.

Learning Outcomes

After completing this module the students will be able:

- To understand the concepts and learn the operations and applications of feedback control system.
- To understand and apply the basic elements of process control.
- To use standard process instrumentation to observe and analyze the controller modes of the four most common parameters in industries.

Contents

- Introduction to process control.
- Elements of Process control.
- Temperature process station.
- Level process station.
- Flow process station.
- Pressure process station.

Pacing Schedule

Contact Hours	Contents	Skills Gained
16	Introduction of Process Control	Introduction to Process Control
	Definition of process control.	
	Manual control & Automatic PID control.	
	Process control block diagram.	
18	Elements of Process Control	Elements of Process Control
	The control function, controlled variable, set point, measured variable, error, disturbance.	
	Temperature Process	
	Temperature measurement using a thermocouple.	
18	Temperature measurement using an RTD.	Temperature Process Station
	On-Off temperature control.	
	Temperature process proportional control.	
	Temperature process proportional control plus integral control.	
	Temperature process proportional plus integral plus derivative.	
	The purpose and general concepts of Temperature measurement, recording, indication and alarm instrumentation.	
	Level Process	
Level process proportional control.		
Level process proportional plus integral control.		
Level process proportional plus integral plus derivative.		
12	The purpose and general concepts of Level measurement, recording, indication and alarm instrumentation.	Flow Process Station
	Flow Process	
	Flow process proportional control.	
	Flow process proportional plus integral control.	
12	Flow process proportional plus integral plus derivative.	Pressure Process Station
	The purpose and general concepts of Flow measurement, recording, indication and alarm instrumentation.	
	Pressure Process	
	Pressure process proportional control.	
12	Pressure process proportional plus integral control.	Pressure Process Station
	Pressure process proportional plus integral plus derivative.	
	The purpose and general concepts of Process measurement, recording, indication and alarm instrumentation.	

Reference:
Principles of Control (In House).

Prerequisite —

Level 2

Contact Hours: 64

Module Description

This module covers skills for connecting various instruments and components to create a project. During this module the student will know skills for connecting different process instruments, sensors & Gas detector and other external control devices commonly used in Industrial Instrumentation. The module also teaches wire splicing and soldering techniques.

Objectives

This module:

- Enables the students to use the information they have learnt from other modules to create useful projects that will enlighten them about the importance and applications of all the things they have studied.
- Develops basic conceptual and hands-on skills for Instrumentation technicians to connect different sensors and gas detector in loops.
- Teaches the best splicing techniques and soldering electronic components which is necessary to know for every technician.

Learning Outcomes

By the end of this module, the student will be able to:

- Use hand tools professionally and identify the right tool for the job.
- Identify faulty equipment in a process.
- Connect sensor and gas detector in circuits.
- Select the splicing technique for wires and be able to do the splicing.
- Solder electronic components and distinguish between good and bad solder joints.

Contents

- Safety at work.
- Process instruments experiments.
- Exploring sensors & gas detector.
- Electronic soldering and wire splicing.

Pacing Schedule

Contact Hours	Contents	Skills Gained
2	Safety at Work	Safety practices
	Safety awareness in the workshop and the field.	
30	Process Instrument Experiments	Learn how to connect different instruments to make a process project
	Experiment-1: Electronically controlling a control valve	
	Experiment-2: Connecting the RTD to a control loop	
	Experiment-3: Connecting the thermocouple to a loop	
	Experiment-4: Using strip chart recorders in control loops	
	Experiment-5: Float switch for level control of open tank	
	Experiment-6: Temperature switch and alarm indication	
	Experiment-7: Using the pressure switch in ON/OFF control	
	Experiment-8: Pneumatic cylinder with solenoid control	
	Experiment-9: PID control in process control loop	
	Experiment-10: Control valve with I/P positioner	
20	Exploring Sensors & Gas detector	Connecting Sensors circuits
	Project-1 (Introduction for Gas detector, sensor calibration and connecting its alarm circuit)	
	Project-2 (Connect plunger-switch load circuit and NO/NC magnetic circuit)	
	Project-3 (Connect shock/vibration sensor alarm circuit & infrared photoelectric sensor load circuit)	
	Project -4 Identification and Connecting the Exploring Sensors trainer components.	
12	Electronic Soldering and Wire Splicing	Soldering & Splicing
	Soldering techniques	
	Wire splicing techniques	

Reference:

Instrumentation Skills Practice I (In House).

Prerequisite **ENGC 102**Level **2**Contact Hours: **24****Module Description**

English Communication 2 is a module for level 2 students of specialization program that builds on English Communication 1 as part of the communicative competence requirement for their diploma. The module is built around a communicative competency-based program that focuses on communication skills and workplace competencies.

Objectives

- To consolidate the students' communicative competence achieved at level 1 of the skill program.
- To develop language skills, document literacy, critical thinking and problem solving in workplace situations.
- To develop purposeful use of language in realistic contexts and communicative competence.

Learning Outcomes

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

- Check assumptions, express values and understand social systems
- Express wishes and confirming conjectures
- Summarize, bargain and predict things
- Analyze and express values and judgments, negotiate and talk about causes and effects.

Contents

- Career Planning and Self-Assessment
- Taxes and Tax Forma
- Rights, Responsibilities and Benefits.
- Performance Reviews
- Health Problems on the Job
- Emergency Procedures
- Scheduling and Budgeting
- Using Computers
- Job Promotions

Pacing Schedule

Contact Hours	Contents	Skills Gained
3	Career Planning and Self-Assessment	Checking assumptions, expressing values and analyzing using tag questions and appropriate noun clauses
3	Taxes and Tax forms	Paraphrasing and confirming conjectures using past subjunctive and direct speech
Quiz 1		
3	Rights and Responsibilities	Summarizing, bargaining and predicting using future perfect and future conditional
3	Performance Reviews	Reporting information and complimenting using passive simple future and passive present perfect
Midterm		
3	Health Problems on the Job	Predicting and analyzing using future perfect continuous.
3	Emergency Procedures	Expressing values, requesting information and predicting consequences using present continuous conditional and embedded questions.
Quiz 2		
3	Scheduling and Budgeting	Compromising and negotiating using clauses with 'although' and 'unless'.
3	Using Computers and Job Promotions	Talking about possibility, cause and effect and expressing judgment using causative and past unreal conditional
Final Examination		

Reference: Put English to Work – Level 6 by Sally Gearhart

Prerequisite —

Level 3

Contact Hours: 88

Module Description

This module teaches students more information about instruments, including horizontal and vertical mounting, process connections, testing, troubleshooting, isolating, calibrating and maintaining the instruments. The module also includes the comparison between the old and new technology in measuring variables.

Objectives

This module includes:

- Intensively practical exercises that help the student know how the instruments are working properly, how to test the operations and evaluates based on the actual results.
- Troubleshooting, maintaining and calibrating those instruments, which is a fundamental skill for any instrumentation technician especially in petrochemical plants.

Learning Outcomes

After completing this module, the student will be able to:

- Test a wide range of measuring instruments (level, flow, temperature, pressure instruments) and give a judgment as to whether the instruments should be repaired or replaced.
- Calibrate and do high-level and low-level maintenance to instruments.

Contents

- Switches.
- Temperature sensors & transmitters.
- Signal converters.
- Pressure instruments.
- Smart transmitters.
- Other instruments and transducers

Pacing Schedule

Contact Hours	Contents	Skills Gained
12	Switches	Calibrating & maintaining switches
	Overall safety when handling instruments	
	Pressure and Differential Pressure switches	
	Temperature and Flow switches	
12	Temperature Sensors & Transmitters	Testing & maintaining temperature instruments
	Thermocouple	
	Thermocouple transmitter	
	RTD	
	RTD transmitter	
12	Signal Converters	Testing and maintaining signal converters
	Pressure to current converter	
	Foxboro current to pressure converter	
	Rosemount current to pressure converter	
16	Pressure Instruments	Testing & maintaining pressure instruments
	Pressure measurement	
	Pressure gauge	
	Pneumatic pressure transmitter	
	Pneumatic differential pressure transmitter	
	Connecting & using the hand pump	
18	Smart Transmitters	Testing & maintaining smart transmitters
	Smart pressure transmitter	
	Smart differential pressure transmitter	
	Using the HHT to test & calibrate smart transmitters	
18	Other Instruments and Transducers	Testing and maintaining various instruments
	Vibrating sensor level meter and switch	
	Pneumatic controller	
	Ultra-sonic level and flow sensor	

Reference:
Instruments Calibration and Maintenance (In House).

Prerequisite —

Level **3**Contact Hours: **88**

- Module Description** The module covers the operation of a typical Distributed Control System (DCS) which is similar to Honeywell TDC3000 and is commonly used to control and monitor the whole plant process.
- Objectives** This module includes:
With the help of various simulated process student would be able to understand what they have to do in case of any fault.
How they can change the set point/parameter of any controller.
How they can analyze the cause of plant trip, etc.
- Learning Outcomes** After completing this module the student will be able to operate, tune, troubleshoot and understand controls and control loops by practicing practical exercises from program manual for the AUDY 5900M Basic Instrumentation Training Program.
- Contents** Introduction to DCS.
Keyboard Practice.
Reading Graphics.
Practical Exercises.

Pacing Schedule

Contact Hour	Contents	Skills Gained
24	Introduction to DCS	Basic Concept of DCS
	Introduction to Distributed Control System	
	Standard Panel Controller vs DCS	
	Familiarization with DCS System Architecture	
16	Keyboard Practice	Keyboard Operation & Operating Commands Skills
	Commands of DCS System	
	Mastering Keyboard	
	Getting started with DCS system	
	Point-to-Point control	
24	Reading Graphics	Reading control graphics displays & process unit operations.
	Reading Interactive Schematics	
	Process-1 Operation (Self-Regulating gravity drained holding tank)	
	Process-2 Operation (Non-Self Regulating pumped holding tank)	
24	Practical Exercises	Process operation's, startup & shutdown procedures.
	Process-3 Operation (Non-Linear Process PH Mixing tank)	
	Process-4 Operation (Heat Exchanger)	
	Process-5 Operation (Three Element Boiler Control)	
	Startup & Shutdown procedure for different unit operations	

Reference:

Distributed Control System Operation (In-house)

Prerequisite —

Level 3

Contact Hours: 64

Module Description

This module covers with the process control components symbols, digital control interpretation, types of P&ID diagrams and describing instrument loop diagram and how to locate the instruments in the plant.

Objectives

This module provides:

- Development to the skills of students in reading and dealing with process and instrumentation diagrams.
- Basic skills associated with pipe and topics related to the importance of instrumentation and control diagrams in troubleshooting faulty components and instruments in process control.

Learning Outcomes

After completing this module the student will be able:

- To identify the type of instrument signal used from the line symbol.
- To locate instruments in a given process.
- To interpret a Process and Instrumentation Diagram describing how the process is measured and controlled to understand the operation of a given process.

Contents

- Piping and Instrumentation Diagram.
- Digital Control Interpretation.
- Types of P&ID Diagrams.
- Instrument Loop Diagrams.
- Graphic Symbols for Process Flow Diagram

Pacing Schedule

Contact Hours	Contents	Skills Gained
18	Piping and Instrumentation Diagram	Piping and Instrumentation Diagram
	P&ID layout.	
	P&ID legend	
	Basic instruments symbols.	
	Miscellaneous instrument connections & symbols	
	Identify instrument abbreviations.	
	Process loop.	
	Line symbols.	
	Line Schedule & line designation.	
	Tracing and insulation.	
	Control valve symbols.	
	Equipment symbols.	
6	Digital Control Interpretation	Digital Control Interpretation
	Digital control concepts.	
	Symbols and designations.	
15	Types of P&ID diagrams	Know Types of P&ID Diagrams
	The function of the instrument.	
	Interlocks.	
	Logic reading	
	Simplified diagram.	
	Conceptual Diagram	
21	Instrument Loop Diagrams	Know Instrument Loop Diagrams
	Selecting a loop diagram.	
	Instrument port connection and junction box.	
	Power Sources.	
	Calibration Information, Set point.	
	Controller action.	
	Reading a pneumatic loop diagram.	
Reading an electronic loop Diagram.		
4	Graphic Symbols for Process Flow Diagram	Reading and Interpreting PFD
	Miscellaneous Diagram	

Reference:

Piping & Instrumentation Diagrams Reading (In House).

Prerequisite —

Level **3**Contact Hours: **24****Module Description**

Technical Report Writing 1, is offered to students to improve their English language proficiency in writing short technical reports which is part of their diploma requirement. The module integrates different methods of report writing with the basic mechanics organized writing.

Objectives

- To consolidate and extend the writing skills they have learned in ENGC 203.
- To help technical student write short reports involving technical expression.

Learning Outcomes

After completing this module the student will be able to:

- use writing as a means of communication in work environments
- write short reports involving technical expression
- organize information using the mechanics of writing

Contents

- Introduction to Technical Report Writing
- Precaution Instructions
- Operational Instructions
- Progress Reports
- Accident Reports
- Industrial Visit Reports

Pacing Schedule

Contact Hours	Contents	Skills Gained
3	Introduction to Technical Report Writing	Learning the basics of paragraph writing
3	Precaution Instructions	Sequencing precautionary instructions following the rules of writing
Quiz 1		
4	Operational Instructions	Writing operational instructions using the imperative form of verb
Midterm		
5	Progress Reports	Ability to write reports on jobs completed and not completed using present perfect and past simple verb forms
Quiz 2		
5	Accident Reports	Writing short reports on causes and consequences of accidents using past tense verb forms
4	Industrial Visit Reports	Reporting industrial visit experiences using past tense verb forms
Final Examination		

Reference: Technical Report Writing 1 (In-house made)

Module Description

This module broadens the student's knowledge about measuring instruments and transducers and how to modify the signals of transducers to get useful readings.

Objectives

This module provides:

- The opportunity for the students to use the operation amplifier (op amp) in various circuits as this component is extensively used in the industries.
- It also allows the students to understand the various types of signal conditioning circuits to ease troubleshooting of instruments and transducers in the field.

Learning Outcomes

After completing this module:

- Student will be able to identify the signal conditioning methods for different transducers, use measuring instruments in electrical circuits to modify the instruments' output.
- He will then build the skills necessary to understand the process and to troubleshoot not only instruments, but instruments' circuits too.

Contents

- Operational amplifier.
- Signal conditioning of temperature transducers.
- Transducers and their circuits.
- Level and flow measurement.

Prerequisite —

Level 4

Contact Hours: 88

Pacing Schedule

Contact Hours	Contents	Skills Gained
16	Operational Amplifier	Connecting the op amp to electronic circuits
	Operational amplifier specification and operation	
	Applications of operational amplifier	
	Op amp practical	
24	Signal Conditioning of Temperature Transducers	Connecting and troubleshooting RTD & thermocouple signal conditioning circuits
	RTD, types, uses, applications	
	Signal conditioning of RTD signals with the constant current source techniques	
	Signal conditioning of RTD signals with bridge circuits	
	Amplification of thermocouple signals	
	Cold-junction compensation techniques for thermocouples	
	Transducer fundamentals	
36	Transducers and their Circuits	Identifying, connecting, and testing various transducers and circuits
	Introduction to the transducer fundamentals circuit board	
	IC transducer	
	IC transducer circuits	
	The thermistor	
	Thermistor circuits (Wheatstone bridge)	
	RTD	
	RTD circuits	
	Strain gauge	
	Strain gauge circuits	
	The ultra-sonic transducer	
	Ultra-sonic transducer circuits	
12	Level, Temperature and Flow measurement	Connecting and testing level, and flow transducers
	Flow measurement with the paddle wheel meter	
	Level measurement with pressure transducer/transmitter	

Reference:

Electronic Instrumentation (In House).

Module Description This module covers the use of ladder programs to control the process. And also the conversions of the old relay system to a PLC system. And how to use this new system of PLC.

Objectives This module provides the opportunity for the students to:

- Practice working with the PLC programs and checking inputs and outputs of the PLC.
- Develop the student's skill in testing and fault tracking.

Learning Outcomes After completing this module, the student will be able to:

- Write and modify programs inside the PLC
- Download and upload programs between a PLC and a programming device
- Connect PLC inputs and outputs to real-world device
- Troubleshoot PLC controlled processes and instruments including testing, fault finding, signal tracking, and repairing.

Contents

- Basic digital control.
- Microprocessor-Based control.
- PLC Instructions.
- Motor control using a PLC.
- Micro-Projects.
- Troubleshooting PLC systems.

Prerequisite —

Level **4**

Contact Hours: **88**

Pacing Schedule

Contact Hours	Contents	Skills Gained
12	Basic Digital Control	Building and wiring relay control circuits
	Solving problems with relay control systems	
	Applications of relay control systems	
	Solving problems with relay control circuit	
	Building and wiring relay control circuits	
12	Microprocessor-Based Control	Entering programs to a PLC
	Introduction to ladder diagrams	
	Why microprocessor-based control is better	
	Programming exercises and practices	
	Downloading, uploading, modifying programs	
	More input and output instructions	
16	PLC Instructions	Using timers and counters to control processes
	The timer instruction, types of timers	
	Practical exercises on timers	
	The counter instruction, types of counters	
	Practical exercises on counters	
	Applying timers and counters in control circuits	
12	Motor control using a PLC	Motor control using a PLC
	Comparison Instructions	
	Practical exercises on comparison instructions	
	Motor control	
24	Micro-Projects	Applying the PLC in real life applications
	Controlling a traffic light with a PLC	
	Controlling a car park with a PLC	
	Controlling the mechanical process simulator with the PLC	
	Controlling a filling line with PLC	
	Controlling an Induction motor with PLC	
12	Troubleshooting PLC Systems	Finding Faults & repair of PLC systems
	Troubleshooting techniques and signal tracking	

Reference:

PLC Programming and Interfacing (Lab-Volt).

Module Description This module covers the systematic approach of the system startup, tuning, and logical troubleshooting skills which are all critical importance to the instrument technician.

- Objectives**
- To familiarize students with actual Industrial Process system used in process measurement and control by using GUNT Modular Training System, Hampden Industrial Process Plant Trainer and Siemens PLC's for operating Variable speed drives.

- Learning Outcomes** After completing this module the student will be able to:
- Connect different sensors in loops
 - Design a complete process engineering system using GUNT (Modular training system)
 - Setup the system mechanically and electrically & test the system, study its behavior
 - Perform feedback control experiments for Pressure, Level, Flow and Temperature by using Hampden process Plant trainer.
 - Understand systematic approach to troubleshooting
 - Program Siemens PLC's to operate Variable speed drives

- Contents**
- Safety at work.
 - Constructing control loop.
 - Exercises on process plant trainer & faultfinding techniques.
 - PLC & Variable speed drives.

Prerequisite —

Level **4**

Contact Hours: **64**

Pacing Schedule

Contact Hours	Contents	Skills Gained
2	Safety at Work	Safety practices
	Safety awareness in the workshop and the field.	
18	Constructing Control Loop	Connecting loops using sensors & external control Devices (GUNT)
	Project-1 (Level Control System RT450.01 Module)	
	Project-2 (Flow Control System RT450.02 Module)	
	Project-3 (Pressure Control System RT450.03 Module)	
	Project-4 (Temp.Control System RT450.04 Module)	
20	Exercises on Process Plant Trainer & Faultfinding Techniques	Perform Experiments using Hampden Industrial process plant trainer
	Experiment-1 (Feedback Control of Water Flow)	
	Experiment-2 (Feedback Control of oil Flow using Control Valve)	
	Experiment-3 (Feedback Control of oil Flow using Variable Speed Drive)	
	Experiment-4 (Feedback Control of water level in Tower#1)	
	Experiment-5 (Feedback Control of oil level in Tower#1 & Tower#2)	
	Experiment-6 Control using boiler	
24	PLC & Variable Speed Drives	Working with Siemens PLC & Micromaster Variable Speed Drives.
	Siemens Simatic S7	
	Hardware Configuration	
	Siemens Simatic S7,Working with Micromaster	
	WINCC Flexible & Integration with Simatic S7	

Reference:
Instrumentation Skills Practice II (In-house)

Module Description Technical Report Writing 2, is offered to students to enhance and build on their proficiency in writing short technical reports which they learnt at level 3. The module integrates less- controlled methods of report writing with practicing the skill of filling out various forms required at workplace.

- Objectives**
- To consolidate and extend the report writing skills they have learned in TRWT 304.
 - To help technical student write resumes, more work related reports, and fill out forms involving technical and general vocabulary.

- Learning Outcomes** After completing this module the student will be able to:
- use writing as a means of communication in work environments
 - fill out forms and write short reports involving technical expression
 - write resumes and work related reports

- Contents**
- Making Descriptive Requisitions
 - Curriculum Vitae
 - Letter Writing
 - Cooperative Training Report
 - Filling out Requisition Forms
 - Filling Work -Related and General Forms

Pacing Schedule

Contact Hours	Contents	Skills Gained
4	Making Descriptive Requisitions	Making official requests in writing for materials needed at work.
3	Curriculum Vitae	Writing CV's in response to job ads
Quiz 1		
4	Letter Writing	Writing formal cover letters for different jobs
Midterm		
4	Cooperative Training Report	Writing relevant reports on cooperative training to department heads
Quiz 2		
5	Filling out Requisition Forms	Ability to make different requisitions by filling out specific forms
4	Filling out Work-related and General Forms	Ability to fill out different forms - an ability required in real life situations
Final Examination		

Reference: Technical Report Writing 2 (In-house made)