<table>
<tr><td>Course Title</td><td>APPLICATION OF PROPORTIONAL HYDRAULICS</td></tr>
<tr><td>Purpose</td><td>Learning the function and control of proportional valves and the structure of basic circuits in practical industrial applications.</td></tr>
<tr><td>Eligibility</td><td>Degree/Diploma in Mechanical engineering, NTC/NAC with relevant trade experience. The participant should have undergone training on basic Pneumatic/Hydraulic (In case sponsored candidate entry qualifications may be relaxed)</td></tr>
<tr><td>Duration</td><td>5 Days</td></tr>
<tr><td>Location</td><td>AVTS Hydraulics & Pneumatics Section</td></tr>
<tr><td>Learning outcomes</td><td>On completion of this course, participants will be able to:
Understand the fundamental principles of proportional control
Recognize the symbols and terminology used to represent and describe proportional hydraulic equipment.
Recognize the component parts of a proportional hydraulic system and understand their functions
Construct, set and adjust simple proportional control circuits
can interpret the characteristic data of proportional valves
can read and interpret proportional hydraulics circuit diagrams
Understand Importance of Fluid cleanliness and filtration.</td></tr>
<tr><td>Teaching methods</td><td>➢ Lectures in class room
➢ Demonstrations
➢ Practical / Group exercises</td></tr>
<tr><td>Assessment methods</td><td>
<table>
<tr><td colspan="3">❖ Formative assessment consists of following things:</td></tr>
<tr><td>Sl.No</td><td>Criteria for Assesment</td><td>Maximum marks</td></tr>
<tr><td>1-A</td><td>Attendance & Punctuality</td><td>20</td></tr>
<tr><td>2-B</td><td>Sincerity</td><td>20</td></tr>
<tr><td>3-C</td><td>Ability to grasp the topic</td><td>10</td></tr>
<tr><td colspan="3">❖ Summative assessment through objective type questions consist of following things</td></tr>
<tr><td>Sl.No</td><td>Criteria for Assesment</td><td>Maximum marks</td></tr>
<tr><td>1</td><td>Test consist of practical knowlwdge</td><td>30</td></tr>
<tr><td>2</td><td>Test consist of Theoretical knowledge</td><td>20</td></tr>
</table>
</td></tr>
<tr><td>Course schedule</td><td>
<table>
<tr><td></td><td>Session</td><td>Topic</td></tr>
<tr><td>DAY 1</td><td>FN</td><td>Admission / Introduction to the course subject
Review of conventional hydraulic control
Fundamental of Proportional control
Advantages of Proportional Hydraulics</td></tr>
<tr><td></td><td>AN</td><td>Proportional valves: design and mode of operation
Types of Proportional Valve and their applications. Overlaps in Proportional Valves
Electrical components of proportional hydraulics
Generation of Set points (analogue and digital)
Development and interpretation of proportional hydraulics circuit diagrams</td></tr>
<tr><td>DAY 2</td><td>FN</td><td>Intensive practical training through setup of circuits according to circuit diagrams and setting parameters.
Practical: (Characteristic curve of a single channel amplifier)
Practical: (Proportional pressure relief valve)</td></tr>
<tr><td></td><td>AN</td><td>Practical: (Pressure Stage circuit)</td></tr>
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<tr><td></td><td>
<table>
<tr><td>DAY 3</td><td>FN</td><td>• Practical: (4/3 way Proportional valve)
• Practical: (Setting of setpoint values with ramps)</td></tr>
<tr><td></td><td>AN</td><td>• Practical: (Accelerating and decelerating actuator, Function diagram with ramps)</td></tr>
<tr><td>DAY 4</td><td>FN</td><td>• Practical: (Process-oriented pressure stages)</td></tr>
<tr><td></td><td>AN</td><td>• Practical: (External control of 2 set points)</td></tr>
<tr><td>DAY 5</td><td>FN</td><td>• Practical: (Load-independent feed)</td></tr>
<tr><td></td><td>AN</td><td>• Feedback and Validation</td></tr>
</table>
</td></tr>
<tr><td>AIDS</td><td>➢ LCD projector
➢ White board
➢ Proportional hydraulics add on components to Basic Hydraulic Trainer Kit
➢ Hydraulic simulation & Instruction software.</td></tr>
<tr><td>Instruction material</td><td>➢ Folder with writing Materials
➢ TD/AVTS/AV10/05/CD
➢ TD/AVTS/AV10/05/CM
➢ TD/AVTS/AV10/05/PPT</td></tr>
</table>

<table>
<tr><td>Course Title</td><td>INDUSTRIAL AUTOMATION WITH ELECTRO-HYDRAULIC & ELECTRO-PNEUMATIC</td></tr>
<tr><td>Purpose</td><td>Provide participants with the skills and knowledge to assemble, commission, maintain and basic troubleshoot electro hydraulic & pneumatic control systems and equipment.</td></tr>
<tr><td>Eligibility</td><td>Degree/Diploma in Mechanical engineering, NTC/NAC with relevant trade experience. The participant should have undergone training in basic Pneumatic/Hydraulic. (In case sponsored candidate entry qualifications may be relaxed)</td></tr>
<tr><td>Duration</td><td>10 Days</td></tr>
<tr><td>Location</td><td>AVTS Hydraulics and Pneumatics Section</td></tr>
<tr><td>Learning outcomes</td><td>At the end of the course the participant would be able to:
Identify basic components in a fluid power system.
Understand the general structure and various steps involved in electro pneumatics/hydraulic controls
Explain the roles of (electro) pneumatic and hydraulic components within a given system.
Carryout measurements and adjustments on pneumatic and hydraulic systems
Differentiate between capacitive and inductive proximity switches.
Differentiate between dominant on and off latching circuits.
Design, assemble and test basic single actuator and multi-actuator electro-hydraulic &pneumatic circuits.
Differentiate the working media and control media in Electro-hydraulic & Electro-pneumatic system.
Recognizing and reading of electrical and fluid power symbols</td></tr>
<tr><td>Teaching methods</td><td>➢ Lectures in class room
➢ Simulation Software
➢ Demonstrations
➢ Practical / Group exercises</td></tr>
<tr><td>Assessment methods</td><td>❖ Formative assessment consists of following things:
<table>
<tr><td>Sl.No</td><td>Criteria for Assesment</td><td>Maximum marks</td></tr>
<tr><td>1-A</td><td>Attendance & Punctuality</td><td>20</td></tr>
<tr><td>2-B</td><td>Sincerity</td><td>20</td></tr>
<tr><td>3-C</td><td>Ability to grasp the topic</td><td>10</td></tr>
</table>
❖ Summative assessment through objective type questions consist of following things
<table>
<tr><td>Sl.No</td><td>Criteria for Assesment</td><td>Maximum marks</td></tr>
<tr><td>1</td><td>Test consist of practical knowledge</td><td>30</td></tr>
<tr><td>2</td><td>Test consist of Theoretical knowledge</td><td>20</td></tr>
</table></td></tr>
<tr><td>Course schedule</td><td>
<table>
<tr><td>DAY</td><td>Session</td><td>Topic</td></tr>
<tr><td>1</td><td>FN</td><td>• Admission / Introduction to the course subject</td></tr>
<tr><td></td><td>AN</td><td>• Introduction to Electro-Hydraulic and Electro-pneumatic system
• Fundamental of electrical technology
• Components in electrical signal control section
• Pneumatic & Hydraulic power section
• Electro-hydraulic / Electro Pneumatic components
• Development and reading of standard circuit diagrams</td></tr>
</table>
</td></tr>
</table>

	2	FN	• Representation of control tasks in operation diagrams • Construction of Electro-hydraulics and Electro-pneumatics circuits. • Manual and automatic operation • Stroke and pressure-dependent controls
		AN	Intensive practical training through development and setup of circuits according to circuit diagrams and setting parameters Practical: Safety and Training Kit familiarisation
	3	FN	Practical: Direct actuation of single/ double acting cylinder.
		AN	Practical: Indirect actuation of Single acting/double acting cylinder with AND- function of input signal.
	4	FN	Practical: Indirect actuation of Single acting/double acting cylinder from two different positions.
		AN	Practical: double acting cylinder direct/indirect actuation with reversal by means of an electrical limit switch.
	5	FN	Practical: Direct/indirect actuation, double acting cylinder with oscillating motion of piston rod.
		AN	Practical: Latching circuit - "Dominating switch-ON signal" Practical: Latching circuit - "Dominating switch-OFF signal"
	6	FN	Practical: Oscillating motion of the piston rod with monitoring of end position by means of magnetic proximity switch.
		AN	Practical: Pressure dependent reversal of double acting cylinder, Indirect actuation. Practical: Pressure dependent reversal with monitoring of end position by means of magnetic proximity switch.
	7	FN	Practical: Coordinated motion control with auxiliary conditions.
		AN	Practical: Double acting cylinder, Differential circuit.
	8	FN	Practical: Double acting cylinder, latching, return stroke using pressure switch. Practical: Double acting cylinder, Interlock, Inching operation.
		AN	Practical: Rapid traverse-slow feed system.
	9	FN	Practical: Multi Pressure system.
		AN	Practical: Pressure dependent sequence control of cylinder and hydraulic motor.
	10	FN	Practical: Position dependent sequence control with two cylinders.
		AN	Feedback & Validation
AIDS	➢ LCD projector ➢ White board ➢ Basic Hydraulic & pneumatic Trainer Kit with add on electrical components. ➢ Fluid simulation & Instruction software.		
Instruction material	➢ Folder with writing Materials ➢ TD/AVTS/AV10/03/CD ➢ TD/AVTS/AV10/03/CM ➢ TD/AVTS/AV10/03/PPT		

<table>
<tr><td>Course Title</td><td>INDUSTRIAL HYDRAULICS</td></tr>
<tr><td>Purpose</td><td>Provide participants with the skills and knowledge to assemble, commission, maintain and troubleshoot basic hydraulic control system and equipment.</td></tr>
<tr><td>Eligibility</td><td>Degree/Diploma in Mechanical engineering, NTC/NAC with relevant trade experience (In case sponsored candidate entry qualifications may be relaxed)</td></tr>
<tr><td>Duration</td><td>5 Days</td></tr>
<tr><td>Location</td><td>AVTS Hydraulics and Pneumatics Section.</td></tr>
<tr><td>Learning outcomes</td><td>On completion of this training course, participants will be able to:
Understand the principles of hydraulics
Understand the basic functions of hydraulic systems
Identifies and describes the construction, design features and operation of Hydraulic components
Recognize circuit symbols and diagrams to ISO 1219
Design and construct basic hydraulic circuits
Read and interpret Basic hydraulic circuit.
Understand safe practices.</td></tr>
<tr><td>Teaching methods</td><td>➢ Lectures in class room
➢ Demonstrations
➢ Practical / Group exercises</td></tr>
<tr><td>Assessment methods</td><td>
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<tr><td colspan="3">❖ Formative assessment consists of following things:</td></tr>
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<tr><td>2-B</td><td>Sincerity</td><td>20</td></tr>
<tr><td>3-C</td><td>Ability to grasp the topic</td><td>10</td></tr>
<tr><td colspan="3">❖ Summative assessment through objective type questions consist of following things</td></tr>
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</table>
</td></tr>
<tr><td>Course schedule</td><td>
<table>
<tr><td>DAY</td><td>Session</td><td>Topic</td></tr>
<tr><td>Day-1</td><td>FN</td><td>• Admission / Introduction to the course subject</td></tr>
<tr><td></td><td>AN</td><td>• Introduction to Hydraulics
• Type of Hydraulics
• Application of Hydraulics
• Physical principles
• Hydraulic fluids</td></tr>
<tr><td>Day-2</td><td>FN</td><td>• General Block diagram of Hydraulic circuits
• Equipment and circuit diagram symbols, reading and interpreting basic hydraulic circuit diagrams.
• Structure and mode of operation of basic hydraulic components
• Hydraulic circuit design and analysis</td></tr>
<tr><td></td><td>AN</td><td>Practical:
➢ Safety and Training Kit familiarisation
➢ Hydraulic components Identification
➢ Physical principle of Hydraulics</td></tr>
<tr><td>Day-3</td><td>FN</td><td>Practical:
➢ Basic double acting cylinder actuation circuit Calculation relating to cylinder motion.
➢ Pilot operated check valve circuit</td></tr>
</table>
</td></tr>
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		AN	Practical: ➢ Pressure reducing Valve circuit Using Pressure relief & Pressure regulating valve. ➢ Meter in /Meter out and Bleed off circuit.
	Day-4	FN	Practical: ➢ Regenerative (differential circuit) ➢ Counter Holding Circuit
		AN	Practical: ➢ Pressure sequencing Circuit ➢ Pressure compensated flow control valve circuit ➢ Feature and function of hydraulic accumulator.
	Day-5	FN	Practical: ➢ Shutoff valve as final control element. ➢ Use of 4/2 as 3/2 and 2/2 valve
		AN	Feedback & Validation.
AIDS	➢ LCD projector ➢ White board ➢ Basic Hydraulic Trainer Kit ➢ Hydraulic simulation & Instruction software.		
Instruction material	➢ Folder with writing Materials ➢ TD/AVTS/AV10/02/CD ➢ TD/AVTS/AV10/02/CM ➢ TD/AVTS/AV10/02/PPT		

<table>
<tr><td>Course Title</td><td>INDUSTRIAL PNEUMATICS</td></tr>
<tr><td>Purpose</td><td>Provide participants with the skills and knowledge to assemble, commission, maintain and troubleshoot basic pneumatic control system and equipment.</td></tr>
<tr><td>Eligibility</td><td>Degree/Diploma in Mechanical engineering, NTC/NAC with relevant trade experience (In case sponsored candidate entry qualifications may be relaxed)</td></tr>
<tr><td>Duration</td><td>5 Days</td></tr>
<tr><td>Location</td><td>AVTS Hydraulics and Pneumatics Section</td></tr>
<tr><td>Learning outcomes</td><td>On completion of this training course, participants will be able to:
Understand the fundamentals of compressed air generation
Identify and describe the design, feature and operation of pneumatic components
Identify symbols for pneumatic components
Design, assemble and test basic pneumatic circuits
Read and Interpret Basic pneumatic circuits
Understand safe practice</td></tr>
<tr><td>Teaching methods</td><td>➢ Lectures in class room
➢ Demonstrations
➢ Practical / Group exercises</td></tr>
<tr><td>Assessment methods</td><td>
<table>
<tr><td colspan="3">❖ Formative assessment consists of following things:</td></tr>
<tr><td>Sl.No</td><td>Criteria for Assesment</td><td>Maximum marks</td></tr>
<tr><td>1-A</td><td>Attendance & Punctuality</td><td>20</td></tr>
<tr><td>2-B</td><td>Sincerity</td><td>20</td></tr>
<tr><td>3-C</td><td>Ability to grasp the topic</td><td>10</td></tr>
<tr><td colspan="3">❖ Summative assessment through objective type questions consist of following things</td></tr>
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<tr><td>Course schedule</td><td>
<table>
<tr><td>DAY</td><td>Session</td><td>Topic</td></tr>
<tr><td>Day-1</td><td>FN</td><td>• Admission / Introduction to the course subject</td></tr>
<tr><td></td><td>AN</td><td>• Fundamentals of compressed air supply: Production, preparation, distribution
• Advantages and disadvantages of Pneumatics
• Application of Pneumatics
• Combination of signal control section and pneumatic power section</td></tr>
<tr><td>Day-2</td><td>FN</td><td>• Function and application of pneumatic components
• Designation and drawing of pneumatic symbols
• Drawing of pneumatic circuits according international standards
• Direct and indirect stroke-dependent controls
• Basic digital logic functions (AND, OR, NOT, RS-Flip-Flop)
• Time-dependent control system with time-delay valve
• Pressure-dependent control system with pressure sequence valve</td></tr>
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</table>

			• Representing of motion sequences and operating status • Trouble-shooting in simple pneumatic controls
		AN	Practical: • Safety and Training Kit familiarisation • Direct control, single-acting cylinder, extending • Direct control, single-acting cylinder, retracting • Velocity control, single-acting cylinder • Quick Exhaust control, Single-acting cylinder.
	Day-3	FN	Practical: • Direct control, double-acting cylinder with detent valve • Indirect control, double-acting cylinder using dual pressure valve (And-gate) • Indirect control, double-acting cylinder using shuttle valve (OR-gate)
		AN	Practical: Continuous reciprocating circuit using Bi-stable valve and time delay. Practical: Single cycle and continuous operation using selector switch. Pressure sequence valve circuit to limit piston force.
	Day-4	FN	Practical: Development and construction of a self-latching circuit with " Dominant Off Behaviour". Indirect actuation of double acting cylinder. Practical: Realization of fast to and fro motion in partial stroke range. Oscillation frequency adjustment.
		AN	Practical: Indirect control of two double acting cylinder with one final control valve. Practical: Indirect control of three actuator with three final control valves.
	Day-5	FN	Practical: Indirect control of two cylinders via two final control components (sequential motion). Final control valves are influenced by signal generator (selector switch, roller lever valve, and adjustable pressure switch
		AN	Feedback & Validation
AIDS	➢ LCD projector ➢ White board ➢ Basic Pneumatic Trainer Kit ➢ Pneumatic simulation & Instruction software.		
Instruction material	➢ Folder with writing Materials ➢ TD/AVTS/AV10/01/CD ➢ TD/AVTS/AV10/01/CM ➢ TD/AVTS/AV10/01/PPT		

<table>
<tr><td>Course Title</td><td>PROGRAMMING OF PLC IN ELECTRO-HYDRAULICS AND ELECTRO-PNEUMATICS.</td></tr>
<tr><td>Purpose</td><td>Provide participants with the skills and knowledge to design, assemble, commission, maintain and troubleshoot a PLC based control system.</td></tr>
<tr><td>Eligibility</td><td>Degree/Diploma in Mechanical engineering, NTC/NAC with relevant trade experience. The participant should have undergone training in Industrial Pneumatic/Hydraulic. (In case sponsored candidate entry qualifications may be relaxed)</td></tr>
<tr><td>Duration</td><td>5 Days</td></tr>
<tr><td>Location</td><td>AVTS Hydraulics and Pneumatics Section</td></tr>
<tr><td>Learning outcomes</td><td>At the end of the course, participants would be able to:
Understand the purpose, functions, and operations of a PLC
Identify the basic components of the PLC
Establish communications with a PLC
Enter a basic PLC program using PLC software
Edit &Save a PLC program to a disk using PLC software
Connect field devices with PLC
Run a PLC program using PLC programming software
View the status of the input and output data tables
Generate and print out a ladder logic report using PLC software</td></tr>
<tr><td>Teaching methods</td><td>➢ Lectures in class room
➢ Demonstrations
➢ Practical exercises</td></tr>
<tr><td>Assessment methods</td><td>
<table>
<tr><td colspan="3">❖ Formative assessment consists of following things:</td></tr>
<tr><td>Sl.No</td><td>Criteria for Assesment</td><td>Maximum marks</td></tr>
<tr><td>1-A</td><td>Attendance & Punctuality</td><td>20</td></tr>
<tr><td>2-B</td><td>Sincerity</td><td>20</td></tr>
<tr><td>3-C</td><td>Ability to grasp the topic</td><td>10</td></tr>
<tr><td colspan="3">❖ Summative assessment through objective type questions consist of following things</td></tr>
<tr><td>Sl.No</td><td>Criteria for Assesment</td><td>Maximum marks</td></tr>
<tr><td>1</td><td>Test consist of practical knowlwdge</td><td>30</td></tr>
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</td></tr>
<tr><td>Course schedule</td><td>
<table>
<tr><td></td><td>Session</td><td>Topic</td></tr>
<tr><td>Day-1</td><td>FN</td><td>Introductions to PLC and industrial applications.
PLC ladder logic and basic programming concepts
Electrical continuity versus logical continuity
Communication between Personal Computers and PLCs.
Read and write programming in Ladder Diagram
Types of inputs and outputs and field devices
Connection of field devices with PLC</td></tr>
<tr><td></td><td>AN</td><td>Programming applications and navigation through Allen-Bradley RS Logix micro software & Siemens Total integrated automation software.</td></tr>
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<table>
<tr><td></td><td></td><td>• Program documentation
• I/O configuration and downloading PLC programs
• Logic functions, Sequence tasks, Timing sequence, Counting sequence
• Practical exercises with troubleshooting and safety consideration.</td></tr>
<tr><td rowspan="2">Day-2</td><td>FN</td><td>Practical: Programming exercises on PLC Trainer kit</td></tr>
<tr><td>AN</td><td>Practical: Programming exercises on PLC Trainer kit</td></tr>
<tr><td rowspan="2">Day-3</td><td>FN</td><td>Practical: PLC programming for control of single actuator through ladder program. (use of logical instructions)</td></tr>
<tr><td>AN</td><td>Practical: PLC programming for control of single actuator through ladder program. (Timer and counter instructions)</td></tr>
<tr><td rowspan="2">Day-4</td><td>FN</td><td>Practical: PLC programming for control of multiple actuators (sequence control)</td></tr>
<tr><td>AN</td><td>Practical: PLC programming for control of multiple actuators (sequence control)</td></tr>
<tr><td rowspan="2">Day-5</td><td>FN</td><td>Practical: PLC programming for control of multiple actuators (Manual, auto, operating sequence control)</td></tr>
<tr><td>AN</td><td>Feedback and validation</td></tr>
</table>
</td></tr>
<tr><td>AIDS</td><td>➢ LCD projector
➢ white board
➢ Basic Hydraulic & Pneumatic Trainer Kit with addon PLC trainer kit
➢ PLC Programming Software</td></tr>
<tr><td>Instruction material</td><td>➢ Folder with writing Materials
➢ TD/AVTS/AV10/04/CD
➢ TD/AVTS/AV10/04/CM
➢ TD/AVTS/AV10/04/PPT</td></tr>
</table>