Singapore Workforce Skills Qualifications (WSQ)
in Precision Engineering

Didactic training course details
SDF grant available

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General Information

Statement of Attainment (SOA)
A Workforce Skills Qualification (WSQ) Statement of Attainment will be issued upon completion and passing the assessment.

Replacement
Any request for replacement of participants must be made in writing and received at least 3 working days before course commencement date. No replacement is allowed once the course has commenced.

Deferment
Any request for deferment of course must be made in writing and received at least 3 working days before course commencement date. If the tax invoice has been issued, payment must be received before the deferment is allowed. No deferment is allowed once the course has commenced.

Withdrawal and Refund Policy
In writing:
• If notice of withdrawal is given 10 working days or more before the course starts - 100% refund
• If notice of withdrawal is given less than 10 working days or more before the course starts - 70% refund
• If notice of withdrawal is given 3 working days or less before the course starts - No refund
• If participants fail to show up for the course - No refund

Registration Form (Please use BLOCK LETTERS)
Please fax to 6261-1026
Competency Training Programme that comes with free assessment *
Programme Code: ___________________________ Date: ___________________________

About Participant A
Name: ___________________________
Department: ___________________________ Job Title: ___________________________
E-mail: ___________________________ Qualification: ___________________________

About Participant B
Name: ___________________________
Department: ___________________________ Job Title: ___________________________
E-mail: ___________________________ Qualification: ___________________________

About the company
Name: ___________________________ Co. Stamp: ___________________________
Address: ___________________________
Contact Person: ___________________________ Job Title: ___________________________
Tel: ___________________________ Fax: ___________________________ E-mail: ___________________________

Contact Us
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Advanced Certificate in Precision Engineering (Concept Engineering)

HN23 Design hydraulic systems

Course Objective
To provide the participant with a wider knowledge of complex hydraulic and electro-hydraulic control systems as well as to develop ability to design, assemble and operate the controls which enable the participant to read and assemble circuits with additional conditions.

Course Content
- Fundamentals of hydraulics:
  - Basic principles and physical laws of hydraulics
- Characteristics and function of hydraulic actuators
- Characteristics and function of hydraulic valves:
  - Pressure control valves
  - Directional control valves
  - Flow control valves
  - Non-return valves
- Construction and principle of electrical components:
  - Electrical switches and contacts
  - Electrical sensors
  - Solenoid operated directional control valves
- ISO electrical and hydraulic symbols according to ISO 1219
- Basic hydraulic circuits
- Development and layout of control tasks:
  - Development steps
  - System structure
- Designing electro-hydraulic systems:
  - Logic functions
  - Memory/Latching function
  - Controlling circuits remotely
- Control with auxiliary conditions:
  - On/off and auto mode
  - Pressure switch control
  - Emergency off, etc.
- Simulation and practical exercises

PN13 Advanced design of pneumatic systems for automation

Course Objective
To provide the participant with a wider knowledge of complex pneumatic and electro-pneumatic control systems as well as to develop ability to design, assemble and operate the controls. Participants would be able to read and assemble circuits with additional conditions.

Course Content
- Functions and characteristics of electro-pneumatic components:
  - Air supply components
  - Directional control valves
  - Other pneumatic valves
  - Switches and contacts
  - Electrical sensors
  - Actuators
- Fundamentals and definitions in control technology:
  - Signal flow and control chain
- ISO electrical and pneumatic symbols according to ISO 1219
- Basic circuits of pneumatic systems
- Types of control:
  - Sequence control
  - Oposing signals circuits
- Sequence control system:
  - Motion sequence representation
  - Signal control with signal cut-off
- Methods of designing circuit diagrams for pneumatic controls:
  - Cascade method
  - Shift register method
- Basic circuits of electro-pneumatic systems
- Methods of designing circuit diagrams for electro-pneumatic controls:
  - Pneumatic memory method
  - Electrical memory method
  - Electric cascade method
  - Electrical stepper method
- Sequence control with auxiliary conditions:
  - On/off and auto mode
  - Single/continuous cycle
  - Emergency off, etc.
- Simulation and practical exercises

About Us
Festo Singapore was established in 1980 as a wholly owned subsidiary of Festo AG & Co. KG, Germany. Festo is a leading industrial automation company, innovating pneumatic, electric drive and motion control related products and solutions for various industries. Festo, with its global presence in 160 countries (250 locations) serves both factory and pneumatic automation.

Festo dedicates itself not only to automation technology but also knowledge advancement, and this is demonstrated through our comprehensive range of learning systems and worldwide recognized vocational training courses which are provided in 39 languages.

With its competence in automation, Festo is proud to collaborate with Singapore Workforce Development Agency (WDA) in developing the skills standard and courses for the industry.

WDA SPUR 90% Programme Fee Grant
The Skills Programme for Upgrading & Resilience (SPUR) is an enhanced funding support scheme developed by WDA and designed to last until November 2010. Under SPUR all Singapore citizens and Permanent Residents are entitled to a 90% programme fee grant. Employers who send their staff for any of our courses under SPUR programs are entitled to absentee payroll (SRP).

For more information on SPUR, please visit www.wda.gov.sg

SDF EasyNet and SkillsConnect
Sending employees for training is now simpler, easier and more convenient with SDF EasyNet or SkillsConnect!

With SDF EasyNet or SkillsConnect, companies pay only the net fees (less SDF Grant) to the training providers. This reduces your cash payment upfront, thus maximising training budget. In addition, it also eliminates the hassle of monitoring disbursement from SDF.

Application and claims for SDF Grant can be done via SDF EasyNet or SkillsConnect! For more information, please visit www.sdf.gov.sg or www.skillsconnect.gov.sg
**Course Outline**

**Certificate in Precision Engineering (Manufacturing & Production)**

**HN21 Operate and setup hydraulic systems**

**Course Objective**
To provide the participant with basic knowledge of the construction and function of hydraulic and electric components as well as to develop the ability to read, design and construct simple hydraulic circuits.

**Course Content**
- Fundamental physical principles of hydraulics:
  - Physical quantities and units in hydraulics
  - Basic physical laws of hydraulics
- Hydraulic systems:
  - Basic hydraulic system
  - Advantages and disadvantages of hydraulics
- Components of hydraulic power pack
- Characteristics and function of hydraulic actuators
- Characteristics and function of hydraulic valves:
  - Pressure control valves
  - Directional control valves
  - Flow control valves
  - Non-return valves
- Construction and principle of electrical components:
  - Electrical switches and contacts
  - Basic electrical sensors
  - Solenoid operated directional control valves
- ISO electrical and hydraulic symbols according to ISO 1219
- Development and layout of simple controls:
  - Basic hydraulic circuits
  - Electro-hydraulic circuits
- Simulation and practical exercises

**SN41 Operate electrical sensors**

**Course Objective**
To provide the participant with knowledge of operating principles of the various types of proximity sensors used for handling and processing technology, including the analysis of sensing range and response characteristics of these sensors. The participant would also be able to identify and connect the sensors.

**Course Content**
- Fundamentals of sensors
- Functions, characteristics and uses of binary proximity sensors:
  - Magnetic proximity sensors
  - Inductive proximity sensors
  - Capacitive proximity sensors
  - Optical proximity sensors
- Ultrasonic proximity sensors
- Functions, characteristics and uses of displacement sensors:
  - Analogue inductive sensors
  - Analogue optical sensors
  - Analogue ultrasonic sensors
- Potentiometer
- Functions, characteristics and uses of force sensors:
  - Strain gauges
  - Load cell
- Functions, characteristics and uses of pressure sensors:
  - Pressure switch
  - Pneumatic-electronic sensor
  - Pressure sensor
- Connection and circuit technology:
  - Two-wire connection
  - Three-wire connection
  - Four-wire connection
  - PNP and NPN
- Simulation and practical exercises

**PN81 Fundamentals of handling systems in industrial automation**

**Course Objective**
To provide participant with the fundamental knowledge and skill on handling technology with pneumatics for industrial handling and assembly applications.

**Course Content**
- Introduction to Handling Technology
  - Automated Handling - definition
  - Basic principles of Handling
  - Handling with pneumatics
- Pneumatic Handling Systems
  - Introduction
  - Pneumatic drives
  - Guide units
  - End effectors
  - Pneumatic control elements (valves)
- Handling with Vacuum
  - Vacuum fundamentals
  - Vacuum generators
  - Suction cups
  - Selection of suction cups
  - Application of vacuum components
- Handling with Grippers
  - Introduction to grippers
  - Classification of grippers
  - Selection of grippers
  - Application area of grippers
  - Criteria to select grippers
- Modular Handling Systems
  - Requirements of Handling and Assembly Technology
  - Modular Handling Systems
  - Special handling units
  - Software calculation and simulation
- Simulation and Practical exercises

**PN82 Fundamentals of electric drives and electromechanical systems**

**Course Objective**
To provide participant with the fundamental knowledge and skill on the different electric motors and its application. Participants will also be able to incorporate the motors to the electrical drive units.

**Course Content**
- Introduction to Electrical Motors
  - How does an electric motor work?
  - Fundamentals
  - Output characteristics
- Types of Industrial Motors
  - DC motors
  - AC motors
- Stepper Motors
  - Introduction
  - Variable resistance (VR) stepper motors
  - Permanent magnet (PM) stepper motors
  - Hybrid stepper motors
  - Phases of stepper motors
  - Stepping angles of stepper motors
  - Advantages and disadvantages of stepper motors
  - Benefits of stepper motors
  - Applications of stepper motors
- Servo Motors
  - Introduction
  - How servo motors work?
  - Brushless servo motors.
  - Servo motor controllers.
  - Feedback systems.
  - Advantages and disadvantages of servo motors
  - Benefits of servo motors
  - Applications of servo motors
- Electromechanical System
  - Introduction
  - Types of electromechanical system
  - Advantages and disadvantages of different designs
  - Applications of electromechanical system
- Complete systems
  - Using the different motors with the different electromechanical devices
  - Applications of electromechanical systems
- Simulation and Practical exercises
Higher Certificate in Precision Engineering (Manufacturing & Production)

Full Higher Certificate in Precision Engineering will be awarded if all 4 core modules and any 4 modules from the specialisation electives stated are completed.

**Core modules**

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<th>Content</th>
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<td>Apply Quality Systems</td>
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<td>GN02</td>
<td>Apply Teamwork in the Workplace</td>
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**Elective modules**

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<td>Understanding pneumatics technology in automation</td>
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<td>PN02</td>
<td>Total preventive maintenance (TPM) of pneumatic systems</td>
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<td>PN03</td>
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<td>EN31</td>
<td>Operate programmable logic controllers (PLC)</td>
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<td>EN32</td>
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<td>EN33</td>
<td>Programming a PLC - Intermediate</td>
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<td>PN04</td>
<td>Fundamentals of Handling Systems in Industrial Automation</td>
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<td>PN05</td>
<td>Fundamentals of Electric Drives and Electromechanical Systems</td>
</tr>
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**CORE MODULES**

**GN01 Apply Quality Systems**

Course Objective

To provide participant with the fundamental knowledge and skill in planning and carrying out their daily work to meet quality system requirements.

Course Content

- Plan daily work to meet quality system requirements
- Carry out daily work to meet quality system requirements
- Maintain work quality
- Improve work quality

**GN02 Apply Teamwork in the Workplace**

Course Objective

To provide participant with the fundamental knowledge and skill in participating in work teams and how to apply them to the workplace.

Course Content

- Participate in team establishment
- Participate in developing team culture
- Communicate with team members
- Assist to improve team performance

**GN03 Apply Workplace Safety and Health Policy**

Course Objective

To provide participant with the fundamental knowledge and skill in identifying and monitoring the hazards, complying with WSH requirements and implementing risk control.

Course Content

- Identify and monitor hazards
- Comply with WSH requirements
- Implement risk controls

**GN04 Apply Continuous Process Improvement Techniques**

Course Objective

To provide participant with the fundamental knowledge and skill in applying continuous process improvement techniques and be able to put it into practice at their workplace.

Course Content

- Identify improvement opportunities
- Carry out continuous improvement activities
- Follow through the improvement activities
ELECTIVE MODULES:

**PN11 Understanding pneumatic technology in automation**

**Course Objective**
To provide the participant with an understanding of the construction and function of pneumatic and electronic components used in automation. Participants will also be able to read, design and construct simple pneumatic circuits.

**Course Content**
- Characteristics of pneumatic systems:
  - Properties of compressed air
  - Advantages and disadvantages of compressed air
  - Structural and signal flow of pneumatic systems
- Compressed air generation, distribution and preparation:
  - Different types of compressors and dryers
  - Role of service units
- Construction and principle of pneumatic valves:
  - Directional control valves
  - Non-return valves
  - Flow control valves
  - Pressure control valves
  - Combinational valves
- Construction and principle of working elements
- Basic pneumatic circuits
- Characteristics of electro-pneumatic systems
- Components and assemblies in the electrical signal control section:
  - Electrical switches
  - Electrical contacts
  - Electrical relays
  - Basic sensors
- ISO electrical and pneumatic symbols according to ISO 1219
- Designing electro-pneumatic circuits:
  - Basic pneumatic circuits
  - Electro-pneumatic circuits
- Operation of pneumatic sequencing circuits:
  - Representation of working sequence
- Simulation and practical exercises

**PN12 TPM of pneumatic systems**

**Course Objective**
To provide the participant with the knowledge of understanding pneumatic systems from the maintenance perspective, a systematic approach to maintenance, troubleshooting and design of pneumatic circuits is practised.

**Course Content**
- Compressed air preparation:
  - Need for clean compressed air
  - Compressed air receiver
  - Air drying
  - Distribution of compressed air
  - Calculation of pipe diameter
  - Air service unit
- Function and construction of pneumatic equipment:
  - Directional control valves
  - Other pneumatic valves
  - Pneumatic actuators
- Methods for the development of pneumatic systems:
  - Control chain
  - Design and layout of circuit diagram
- Maintenance requirements of pneumatic systems
- Operation of pneumatic sequencing circuits:
  - Working sequence
  - Methods of representation
  - Design using cascade control method
- Function and construction of electrical equipment:
  - Switches and contacts
  - Common sensors
  - Solenoid operated directional control valves
- ISO electrical and pneumatic symbols according to ISO 1219
- Designing electro-pneumatic circuits:
  - Using pneumatic memory
  - Using electrical memory
  - Electrical cascade method
  - Electrical stepper method
- Simulation and practical exercises

**EN31 Operate programmable logic controllers**

**Course Objective**
To provide the participant with the knowledge of the characteristics of Programmable Logic Controllers (PLC) and be able to set-up and operate it and participants will also do some basic PLC programming using ladder diagrams.

**Course Content**
- Introduction to Programmable Logic Controllers (PLC):
  - Characteristics
  - Applications
- Design and mode of operation of a PLC:
  - Structure and central control unit of a PLC
  - Input and output module
  - Programming device
- Input devices:
  - Electrical switches
  - Electrical relays and contactors
  - Electrical sensors
- Output devices:
  - Solenoid operated valves
  - Mechanical, pneumatic/hydraulic and man machine interface
- Reading of electrical circuit diagrams
- ISO symbols for signal, control and working elements according to ISO 1219
- Commissioning a PLC:
  - Checking the hardware
  - Transferring and testing of software
  - Optimization of software
  - Commissioning of the system
- Programming Languages according to IEC 61131-3:
  - Ladder diagram
  - Instruction list
  - Function block diagram
  - Structured text
  - Sequential function chart
- Procedure for creating a PLC program
- Programming of control task:
  - Logic functions
  - Sequence tasks
  - Timing sequence
  - Counting sequence
- Multitasking with the PLC:
  - Manual/Auto mode
  - Emergency stop
  - Single/Continuous cycle
  - Parallel programs
- Simulation and practical exercises:
  - Understanding the control task
  - Writing the program
  -Downloading the program
  - Testing the system