CDTI

Training Courses
Competence Development towards Digitalisation

The Joint Training Facility between
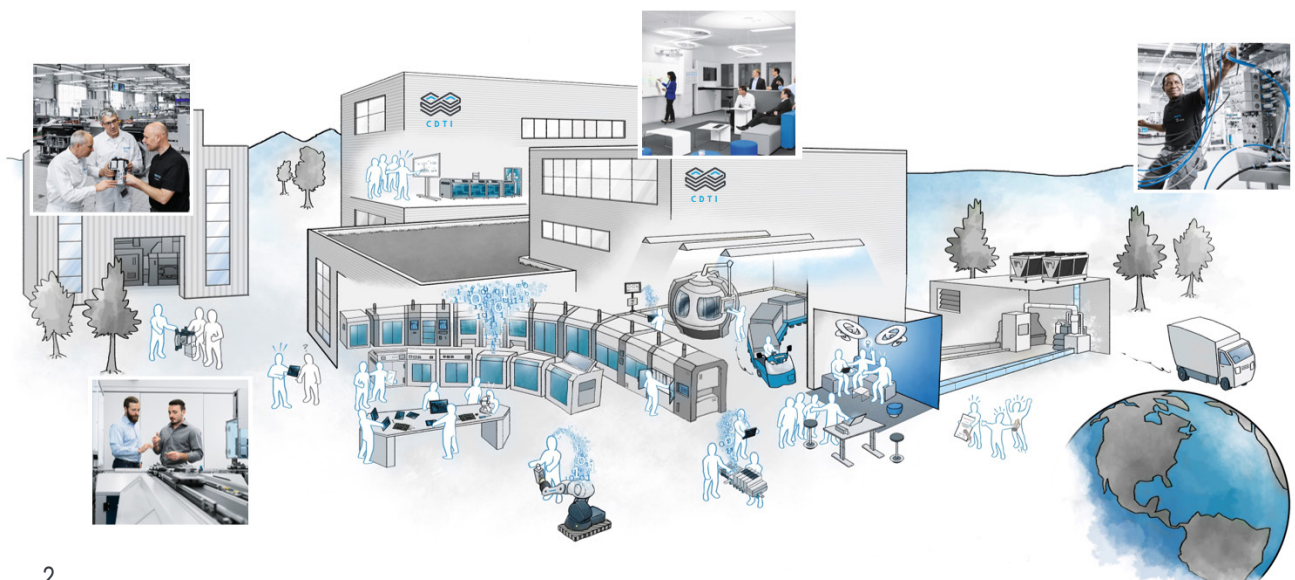
TUM Asia   FESTO

Message from CDTI

Congratulations on taking the first step in your digital transformation journey! If you are reading this message, you are already committed to riding on this unstoppable wave of the digital revolution. The Competence Centre for Digitalisation, Technology and Innovation (CDTI) is a joint training facility between TUM Asia and Festo Didactic which incorporates academic excellence and industrial know-how to provide you with the necessary expertise and experience in Industry 4.0. In the pages that follow, you will understand more of our extensive suite of continuing education and training courses that lead you to various exciting destinations that bring about your digital transformation journey.

In the digital age where the world is increasingly interconnected, customers' demands, and preferences have evolved so rapidly that manufacturers are shifting their value propositions to deliver what customers want. As manufacturers contend with the growing complexity in their customer-supplier relationship, the sector continues to be rocked by demand shocks, severe labour shortage and rising costs amid the uncertain economy. Consequently, many have asked themselves: how could manufacturers rein in more control with the basic laws of demand and supply constantly thrown into chaos? With customers holding the primary power of the business, how can we effectively deliver what customers want while reconciling the manufacturing challenges we face today? The solution lies in talent readiness – the ability of the workforce to drive and deliver Industry 4.0 initiatives.

With every customer touchpoint generating vast amount of information, data becomes the fuel that brings Artificial Intelligence, Machine Learning, and other advanced data-driven applications in the Industry 4.0 ecosystem to life. The collection of vast volumes of data coupled with the wide availability of data storage systems, connectivity, and sensors, has enabled manufacturers to make data-driven and informed decisions remotely to achieve operational efficiency and accuracy. Industry 4.0 also signifies a departure from the previous generations of traditional manufacturing. Combining advanced production and operations techniques with smart digital technologies, you can create a digital enterprise that is inter-connected and automatic, simultaneously communicating, analysing, and translating data to deliver a seamless customer experience.

At CDTI, we aim to help you make sense of all the jargon and legalese – collaborative robots, artificial intelligence, cognitive technologies, the Internet of Things and other digital technologies – to establish a digital ecosystem driven by insights and innovation. We will walk you through how you can transform data into an essential resource within a factory and embed connectivity into every aspect that enables seamless communication between the factory floor, supply chain partners, and demand centres.

The journey towards digital transformation is not easy, but we assure you that the benefits will be immeasurable.

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Mechatronics

Industry 4.0

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About

Competence Centre for Digitalisation, Technology and Innovation (CDTI)

The TUM Asia - FESTO Competence Centre for Digitalisation, Technology, and Innovation (CDTI) provides continuing education and training for companies and individuals through curated rigorous training curricula, consultations, and solutions to meet industry needs. A unique academic-industry collaboration between Technical University of Munich (TUM) Asia and Festo Didactic, CDTI combines academic excellence and industrial know-how to develop a pipeline of future-ready talents that harness the potential of Industry 4.0 to address the evolving needs of the industry.

With the support of Singapore Economic Development Board, CDTI was established with TUM Asia and Festo Didactic penning down its commitment at the Industrial Transformation Asia in 2019. The set-up of the CDTI follows the successful training of over 60 working professionals across various industries in the first jointly developed Specialist Diploma in Advanced Digital Manufacturing in 2018.

CDTI Philosophy

Education
Accelerate the transfer of industry best practices to the manufacturing industry through continuing education and training.

Professional Services
Identify companies' readiness level and generate problem statements based on their target functions.

Innovation
Provide an immersive Industry 4.0 experience centre and a test-bed environment for companies to conduct collaborative sprint-based pilots.

Collaboration
Create an ecosystem for networking and knowledge exchange opportunity with domain experts.

"The professional and comprehensive offering of CDTI is exciting and cements Festo involvement in the Industry 4.0 community. I am convinced that it will equip the participants with the necessary skills and bring a positive impact to industrial workforce development in Singapore"

– Volker Schmid

"Each preceding stage of your CET journey lays the foundation for the next set of competencies development necessary for a sustainable digital transformation. At its outset, you will begin to appreciate how data driven manufacturing make the value chain more responsive, allowing manufacturers to tailor their business models accordingly"

– Dr Markus Wächter

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TUM Asia

Over the past 150 years, the Technical University of Munich (TUM) has continually reinvented itself, paving the way for a steady stream of innovation since 1868. From its modest origins as a polytechnic school, TUM has evolved into an international frontrunner with campuses situated across various strategic parts of the world. Building upon the philosophy of "bringing the igniting spark of science to the commercial and industrial world", today, TUM Asia continues its legacy of shaping an exciting new world in the midst of a digital revolution.

Framed by its vision to shape the future with talent, TUM Asia opened its doors in 2002 to bring German academic excellence to Singapore. Though situated in an Asian country, the academic model employed by TUM Asia is nevertheless German in its roots, with an emphasis on industry readiness and innovation. Offering Bachelor, Master's courses and a suite of executive education courses, TUM Asia strives to be on the front edge of change by constantly scanning the industry landscapes in Asia, refining its approach to education to remain industry-relevant. Partnerships with top Asian universities and industry leaders combine German engineering with Asian relevance to equip talents for industry and research sectors in the world.

In 2010, TUMCREATE, the research arm of TUM Asia, was established to foster research collaborations between Singapore and TUM.
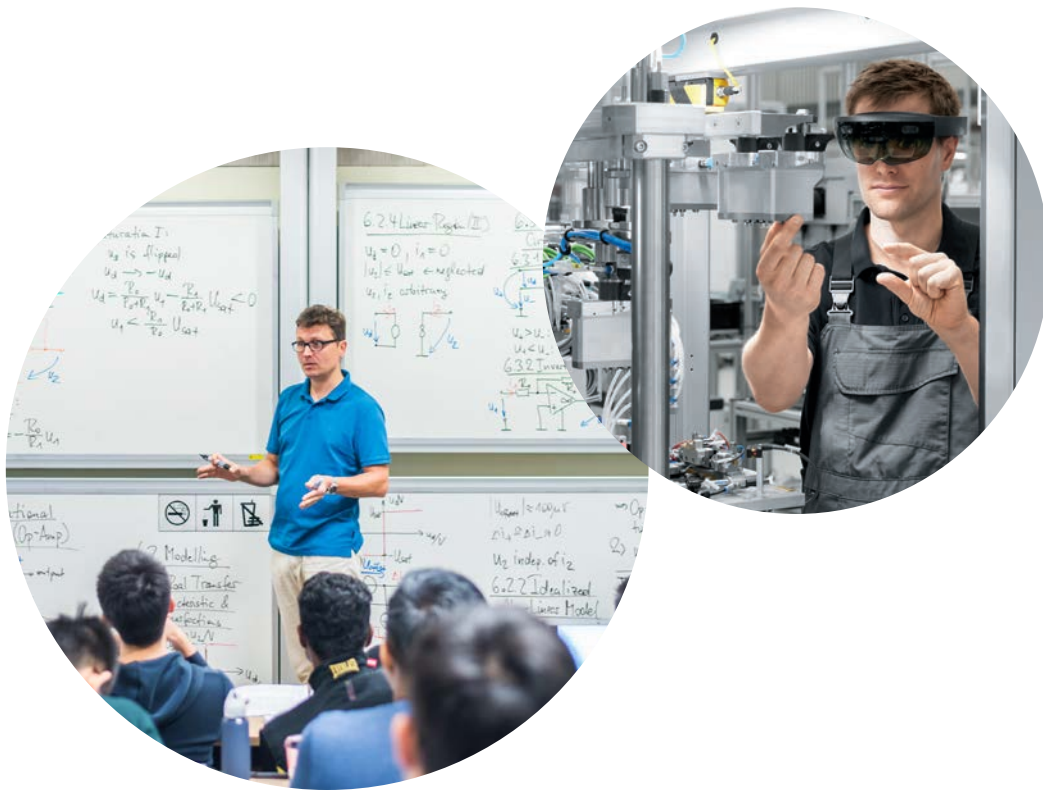
Today's Students, TUMorrow's Engineers

Since 2002, TUM Asia has been offering full-time Master of Science (MSc) programmes. Through partnerships with Asian top universities, TUM Asia offers MSc in Integrated Circuit Design and MSc in Green Electronics conferred by TUM and Nanyang Technology University Singapore; MSc in Industrial Chemistry conferred by TUM and the National University of Singapore; and MSc in Aerospace Engineering and MSc in Rail, Transport and Logistics conferred by TUM. Lecturers and professors hail from as far as Germany and their wealth of knowledge provides a spectrum of experience for students to glean from.

In collaboration with Singapore Institute of Technology (SIT), TUM Asia offers two joint Bachelor of Engineering (BEng) programmes, the BEng in Chemical Engineering (Hons) and the BEng in Electronics and Data Engineering (Hons).

To meet the changing needs of the economy, TUM Asia also launched a new series of executive education courses to deliver leading-edge curricula for the upskilling of industry workforces.

By 2020, more than 1,800 graduands have come through the doors of TUM Asia and now ply their trades in top research institutes and companies across the globe.

The Festo Group

Festo is a world leading German company specialising in industrial control and automation, with a wide product range and services providing automation solution to the many different industries in many countries. Established in 1925, the independent family-owned company based in Esslingen a.N., Germany, has been a driving force in automation for over 60 years.

Festo Didactic provides state-of-the-art training solutions for industrial companies and educational institutions worldwide. The product and service portfolio offer customers holistic education solutions for all areas of technology in factory and process automation. Festo Didactic is the world leader in technical education and a global partner for competence development.

Festo Engagement in Industry 4.0

On the way to the production of the future
Festo has a holistic view of the changes in the production world in various perspectives from change and competence management of human resource in the company to process optimisation with emerging digital technologies.

With holistic digitalisation approach from integrating Industry 4.0 practice into Festo new Scharnhaussen Technology Plant to smart products, digital services, AI and the Industry 4.0 training programme offered by Festo Didactic.

Active networking activities and development of standards
Festo is in close co-operation with industry associates to help create the basis for a uniform understanding of the concept of Industry 4.0 and technological standards.

Festo is a member of
• Plattform Industrie 4.0
• Automation Markup Language (AutomationML)
• Labs Network Industrie 4.0
• OPC Foundation

The Paradigm Shift to the Production of the Future
Industry 4.0

The fourth industrial revolution integrates automation technology and information technology to enhance productivity, efficiency and flexibility in manufacturing processes.

With a high focus on data and connectivity among people and machines, Industry 4.0 technologies enable organisations to become more sustainable and adaptive to changes in market demand.

The driving factors behind this revolution are technology, processes and people.
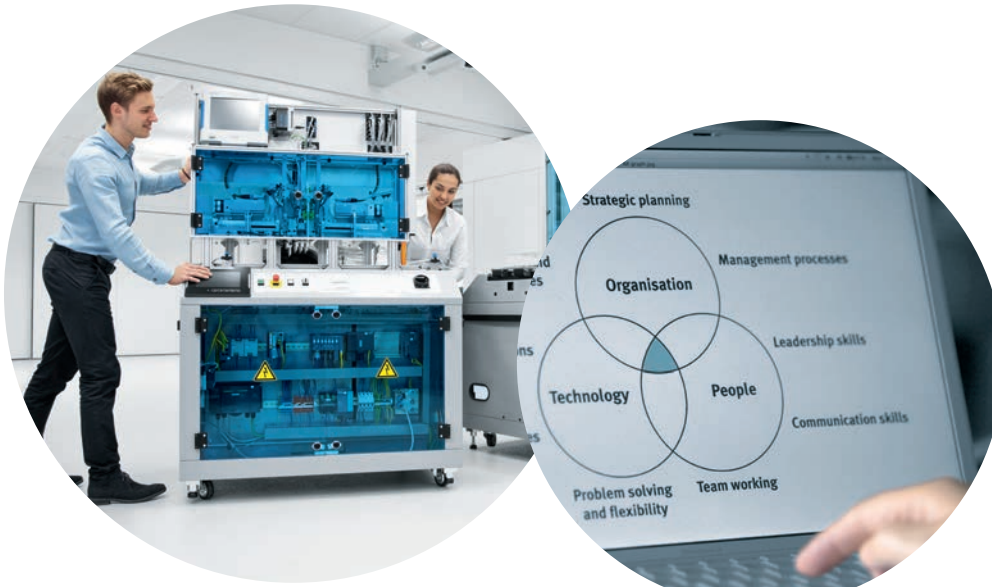
The Main Pillars |
Organisation • Process • Technology

Engineered by people

People remain a crucial success factor in the adoption of Industry 4.0. It is essential for companies to develop transformation roadmaps and strengthen their workforce's skill sets to keep abreast of technological advancements.

The result will be well worth the effort: a thriving organisation and a productive, empowered, and fully engaged workforce.

Driven by process excellence

To maximise the value that Industry 4.0 technology brings, effective and well designed processes must be in place to connect and streamline business activities, and make sure that resources are put to their optimum use.

Powered by technology

Smart factories are now a reality thanks to various digital technologies. By harnessing these innovations, factories can run autonomously as well as aid manufacturers in decision-making. Industry 4.0 technologies also permit decentralised control of production.

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Practice-Oriented Training and Qualification
from **Fundamental Technology** to **Industry 4.0**

CDTI is equipped with state-of-the-art training equipment and highly qualified training personnel in providing a wide range of courses from the fundamental technologies up to Industry 4.0 through progressive learning. The courses offered are suitable for learners who want to acquire skills required for specific work or skill upgrade for career advancement.

The fundamental courses cover the basics of fluid power technology, such as pneumatics, hydraulics and sensoric. These are the fundamental blocks in industrial automation which all in the industry must know. Once, the fundamentals are established, learners can move onto the Mechatronics category where programmable logic controllers are introduced and applied.

With the movement towards Industry 4.0, different technologies are needed to come together. Companies are incorporating I4.0 technologies into their workplace and new business models are developed. With this transformation, the skills of the workforce will also be needed to be upgraded. With the knowledge from the fundamental technology and Mechatronics courses, learners are encouraged to upskill with Industry 4.0 related courses.

CDTI courses are designed to journey with learners advancing from fundamental technology to Industry 4.0 and the Smart Industry Readiness Index (SIRI) created by the Singapore Economic Development Board (EDB) will also be introduced to give learners a more holistic perspective of the underlying concept of Industry 4.0.

SIRI covers the 3 core elements: Process, Technology and Organisation and comprises a suite of frameworks and tools to help manufacturers to start, scale, and sustain their manufacturing transformation journeys. The SIRI Assessment Tool will let companies know the current state of their manufacturing facilities and the result can be compared against manufacturing-wide or industry-specific benchmarks, to understand how their facilities fare vis-a-vis the broader manufacturing community and/or their industry peers.

From Classic Automation Pyramid to Network-Oriented Architecture
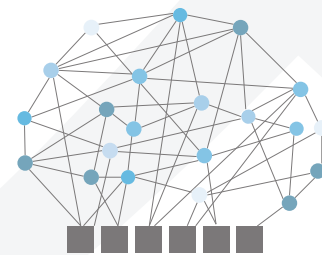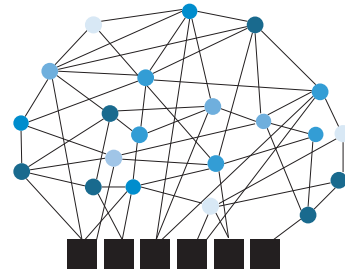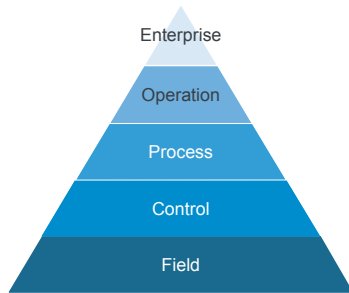
Industry 4.0

Horizontal Integration	Digital Transformation
OPC-UA	Augmented Reality
LEAN and Industry 4.0	Autonomous Robotic
Cyber Physical System	Node-Red Programming
Internet of Things	Smart Sensor & IO-Link
Smart Manufacturing with RFID	Manufacturing Execution System

Mechatronics

Basic PLC	Robotic System
Advanced PLC	HMI
Servo/Stepper Control	Industrial Networking

Fundamental Technology

Pneumatic System	Hydraulic System
Pneumatic Design	Hydraulic Design
Sensors	Maintenance

Fundamental Technology

TFP-11 Understanding Pneumatic Technology in Automation

WSQ course - with SkillsFuture funding up to 70%

Course Description
This course is catered to participants with no or some basic skills in handling pneumatic systems in industrial automation plants or equipment. The participant will be provided with an understanding of pneumatic and electro-pneumatic systems. Participants will be familiar with the design, construction and operation of pneumatic components. This includes the interpretation of circuit diagrams and symbols as well as the construction of simple pneumatic circuits.

Course Outcomes
Participants are able to
- Understand the characteristics of pneumatic and electro-pneumatic systems
- Understand the fundamentals of compressed air generation
- Identify and describe the design, features and operation of pneumatic components
- Identify and explain symbols for pneumatic components
- Identify and describe the design, features and operation of electric components
- Design, assemble and test basic pneumatic circuits
- Understand the operation of pneumatic sequencing circuits

Course Contents
- Characteristics of pneumatic systems
- Compressed air generation, distribution and preparation
- Construction and principle of pneumatic valves
- Construction and principle of pneumatic working elements
- Basic pneumatic circuits
- Characteristics of electro-pneumatic systems
- Components and assemblies in the electrical signal control section
- Construction and principle of the electrical elements
- ISO fluid power symbols according to ISO 1219
- Development and layout of simple controls
- Operation of pneumatic sequencing circuits
- Simulation and practical exercises

Course Duration – 32 hours

TFP-21 TPM of Pneumatic Systems

WSQ course - with SkillsFuture funding up to 70%

Course Description
This course is catered to participants with no or some basic skills in handling pneumatic systems in industrial automation plants or equipment. Participants will gain the knowledge of understanding pneumatic systems from the maintenance perspective, a systematic approach to maintenance, troubleshooting. Basic designs of pneumatic circuits are also practised.

Course Outcomes
Participants are able to
- Identify and describe the design, features and operation of pneumatic components
- Understand the design, features and operation of the components needed for compressed air preparation.
- Identify and describe the design, features and operation of pneumatic components
- Identify and describe the design, features and operation of electric components
- Understand the common failures of components
- Know the characteristics and behaviours of failing components
- Identify root causes of component failures
- Design pneumatic and electro-pneumatic circuits
- Setup, commission and test pneumatic and electro-pneumatic systems
- Maintain and troubleshoot pneumatic components and basic control systems
- Troubleshoot various pneumatic circuits

Course Contents
- Compressed air generation and distribution
- Function and construction of pneumatic control valves
- Function and construction of pneumatic actuators
- Methods for the development of pneumatic systems
- Maintenance requirements of pneumatic systems
- Operation of pneumatic sequencing circuits
- Design pneumatic circuits using cascade control method
- Function and construction of switches and contacts
- Function and construction of electrical sensors
- Function and construction of solenoid operated directional control valves
- ISO fluid power symbols according to ISO 1219
- Designing electro-pneumatic circuits
- Basic troubleshooting of pneumatic circuits
- Simulation and practical exercises

Course Duration – 32 hours

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TFP-33 Advanced Design of Pneumatic Systems

Course Description

This course is catered to participants with a wider knowledge of complex pneumatic and electro-pneumatic control systems as well as to develop the ability to design, assemble and operate the controls. Participants would be able to design and assemble circuits with additional conditions.

Course Outcomes

Participants are able to

- Recap the components used in pneumatic and electro-pneumatic systems
- Design and test complex pneumatic and electro-pneumatic circuits
- Understand the different designing methods and their applications.
- Design circuits with 4 cylinders or more
- Setup and commission pneumatic and electro-pneumatic systems
- Troubleshoot various pneumatic circuits

Course Contents

- Functions and characteristics of pneumatic components
- Functions and characteristics of electro-pneumatic components
- Fundamentals and definitions in control technology: Signal flow and control chain
- ISO fluid power symbols according to ISO 1219
- Basic circuits of pneumatic systems
- Types of control: sequence control and opposing signals circuits
- Sequence control system
- Methods of designing circuit diagrams for pneumatic controls; cascade method and shift register method
- Basic circuits of electro-pneumatic systems
- Methods of designing circuit diagrams for electro-pneumatic controls; electrical cascade, shift register and stepper methods.
- Sequence control with auxiliary conditions
- Simulation and practical exercises

Course Duration – 32 hours

TFH-11   Operate Hydraulic Systems

WSQ course - with SkillsFuture funding up to 70%

Course Description
This course is catered to participants with no or some basic skills in handling hydraulic and electro-hydraulic systems in industries. Participants with be provided with the 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 Outcomes
Participants are able to
- Understand the characteristics of hydraulic and electro-hydraulic systems
- Understand the physical principles of hydraulics
- Identify and describe the construction, design features, and operation of hydraulic components
- Identify and explain graphical symbols for hydraulic components
- Identify and describe the design, features and operation of electric components
- Design, assemble and test basic hydraulic circuits

Course Contents
- Fundamental physical principles of hydraulics
- Hydraulic systems
- Components of hydraulic power pack
- Characteristics and function of hydraulic actuators
- Characteristics and function of pressure control valves
- Characteristics and function of directional control valves
- Characteristics and function of flow control valves
- Characteristics and function of non-return valves
- Construction and principle of electrical switches, contacts and electrical sensors
- Characteristics and function of solenoid operated directional control valves
- ISO fluid power symbols according to ISO 1219
- Development and layout of simple controls
- Design and assemble basic hydraulic circuits
- Design and assemble basic electro-hydraulic circuits
- Simulation and practical exercises

Course Duration – 32 hours

TFH-21   Maintain and Repair Hydraulic Systems

WSQ course - with SkillsFuture funding up to 70%

Course Description
This course is catered to participants with no or some basic skills in handling hydraulic or electro-hydraulic systems in industrial plants or equipment. The participant will be taking care of the maintenance of the hydraulic systems. Participants will be provided with the knowledge of hydraulic control systems, a systematic approach to maintenance, troubleshooting and designing of hydraulic circuits.

Course Outcomes
Participants are able to
- Identify and describe the design, features and operation of hydraulic components
- Understand the design, features and operation of the components needed for the hydraulic power pack.
- Identify and describe the design, features and operation of hydraulic components
- Identify and describe the design, features and operation of electric components
- Understand the common failures of components
- Know the characteristics and behaviors of failing components
- Know the efficient maintenance methods
- Identify root causes of component failures
- Design hydraulic and electro hydraulic circuits
- Setup, commission and test hydraulic and electro-hydraulic systems
- Apply the principles and documentation for systematic troubleshooting in hydraulic circuits
- Read and analyse hydraulic circuit diagrams

Course Contents
- Basic principles of hydraulics
- Function and construction of components used in the power supply section
- Function and maintenance requirements of hydraulic components
- Function and maintenance of electrical components
- Fault identification and location
- Logical troubleshooting
- Maintenance requirements of hydraulic systems
- ISO fluid power symbols according to ISO 1219
- Development and layout of sequence controls
- Electrical logic functions
- Reading hydraulic circuit diagrams
- Simulation and practical exercises

Course Duration – 32 hours

TFH-33 Design Hydraulic Equipment and Systems

Course Description
This course is catered to participants with some basic skills in handling hydraulic and electro-hydraulic systems in industrial plants or equipment. Participants will be provided 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 Outcomes
Participants are able to
- Recap the components used in hydraulic and electro-hydraulic systems
- Design and test complex hydraulic and electro-hydraulic circuits
- Design hydraulic systems
- Understand the functions and uses of cartridge valves
- Setup and commission hydraulic and electro-hydraulic systems
- Troubleshoot various hydraulic circuits

Course Contents
- Fundamentals of hydraulics
- Basic principles and physical laws of hydraulics
- Characteristics and function of hydraulic actuators
- Characteristics and function of hydraulic valves
- Construction and principle of electrical components
- ISO fluid power symbols according to ISO 1219
- Hydraulic circuits
- Development and layout of control tasks
- Designing electro-hydraulic systems
- Control with auxiliary conditions
- Cartridge valves
- Simulation and practical exercises

Course Duration – 32 hours

TFS-12 Fundamentals of Sensor and Smart Sensor with IO-Link

WSQ course - with SkillsFuture funding up to 70%

Course Objective
This course will cover the knowledge of operating principles of the various types of proximity and smart sensors used for handling and processing technology. Participants will be able to identify the various sensors and their applications in various industrial situations. Practical sessions on their usage will be provided.

Course Outcomes
Participants are able to
- Identify the different types of industrial sensors
- Describe the functions, characteristics and uses of binary proximity sensors
- Describe the functions, characteristics and uses of analogue proximity sensors
- Describe the functions, characteristics and uses of smart sensors
- Understand the connection and circuit technology for sensors
- Wire up the sensors

Course Contents
- Fundamentals of sensors
- Binary proximity sensors
- Analogue proximity sensors
- Displacement sensors
- Force sensors
- Pressure sensors
- Connection and circuit technology
- Smart sensors
- Simulation and practical exercises

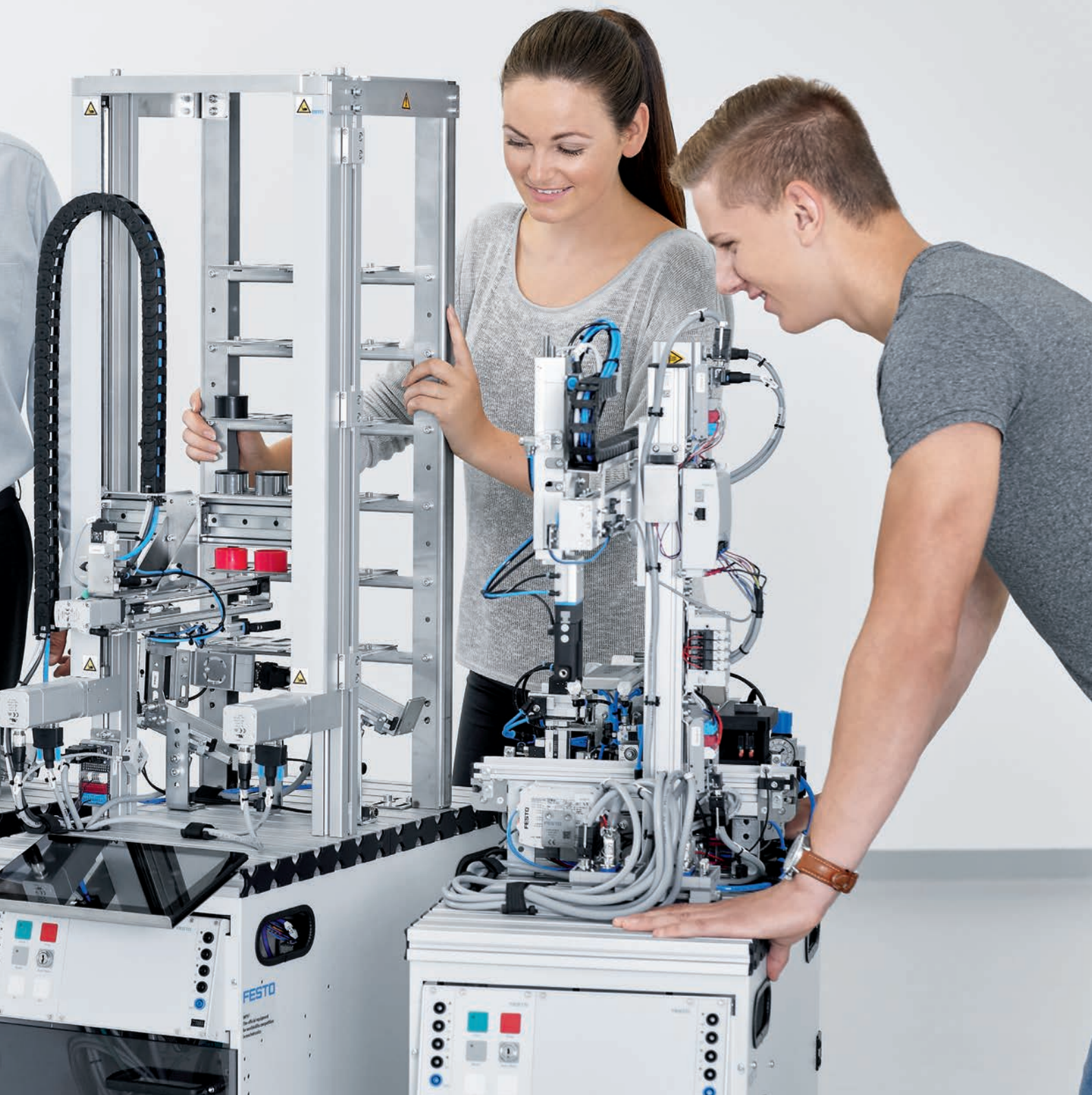**Course Duration** – 32 hours

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TCP-31 PLC Programming - Basic

WSQ course - with SkillsFuture funding up to 70%

Course Description

This course is catered to participants with no or some basic skills in handling Programmable Logic Controllers (PLC) in industrial automation plants or equipment. The participant will learn the input and output devices and the operation of the PLC. The participant would also be able to write, enter, and execute basic logic functions based on the IEC 61131-3 standard.

Course Outcomes

Participants are able to
• Understand the characteristics and applications of a PLC
• Know the design and mode of operation of a PLC
• Know the different input and output devices
• Identify the input and output signals from a PLC
• Read circuit diagrams
• Select PLC appropriately
• Understand the IEC 61131-3 PLC programming standard and the programming languages
• Be able to program the PLC
• Be able to commission and operate a PLC
• Be able to download the program to the Modular Production System and test the program

Course Contents

• Introduction to Programmable Logic Controllers (PLC)
• Design and mode of operation of a PLC
• Input and output devices
• 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
• Programming Languages according to IEC 61131-3
• Programming of simple logic functions
• Basic programming with signal edges, setting and resetting, timers and counters
• Basic programming with linear sequencing
• Simulation and practical exercises

Course Duration – 32 hours

TCP-32 PLC Programming - Intermediate

WSQ course - with SkillsFuture funding up to 70%

Course Description

This course provides the participant with knowledge of construction and operation of a Programmable Logic Controller (PLC) and be able to translate control tasks into operational PLC programs. The participant would be able to write, enter, and execute application programs based on the IEC 61131-3 standard. The use of the Modular Production System (MPS) will give the participant practical programming and troubleshooting skills.

Course Outcomes

Participants are able to
• Understand the purpose, functions, and operations of a PLC
• Understand the classification of control systems
• Know the Input/output systems of PLC
• Know IEC 61131-3 and the programming languages
• Know the peripheral devices and interfacing
• Understand what is needed when selecting a PLC
• Use the PLC programming software
• Create a PLC project using PLC software
• Program basic logic functions with the PLC
• Program using signal edges, setting and resetting outputs, timers and counters with the PLC
• Write sequencing programs with the PLC
• Add additional requirements to the PLC program
• Commission and operate a PLC
• Design function blocks
• Write programs for automation lines
• Download the program to the Modular Production System (MPS) and test the program
• Communicate between the stations of the MPS

Course Contents

• Functions and applications of PLC
• Components of a PLC and PLC addresses
• Programming Languages according to IEC 61131-3
• Procedure for creating a PLC program
• Programming of control task from logic functions to sequencing
• Programming additional tasks
• Programming of modular production systems
• Multitasking with the PLC
• Communication between PLCs
• Testing the system
• Simulation and practical exercises

Course Duration – 32 hours

TCP-33   PLC Programming with HMI and Ethernet Communication

WSQ course - with SkillsFuture funding up to 70%

Course Description

This course will cover the advanced applications of Programmable Logic Controller (PLC) operations, including symbology and programming techniques. PLC data structures will be presented. The participant will write, enter, and execute application programs using the programmable controllers and Human Machine Interface (HMI). The use of the Cyber Physical System will provide the participant practical programming and troubleshooting skills used in automated systems

Course Outcomes

Participants are able to

- Understand the purpose, functions, and operations of a PLC
- Know IEC 61131-3 and the programming languages
- Use the PLC programming software
- Create a PLC project using PLC software
- Program basic logic functions with the PLC
- Program using signal edges, setting and resetting outputs, timers and counters with the PLC
- Write sequencing programs with the PLC
- Commission and operate a PLC
- Design function blocks
- Write programs for automation lines
- Design the components in the HMI
- Do HMI programming and link to the CP Lab
- Download the program to the Cyber Physical Lab (CP Lab) application modules and test the program
- Communicate between the stations of the CP Lab using Profinet

Course Content

- Introduction to a PLC: hardware and software, programming device, general structure of PLC program
- PLC data type and addressing
- Commissioning a PLC
- Programming of control task
- Multitasking with the PLC
- Sequence control systems
- Structured programming
- Human Machine Interface (HMI)
- Industrial communication and networking
- Machine-to-machine communication via Profinet
- Simulation and practical exercises

Course Duration – 32 hours

TCR-32 Robotic Handling Systems with Gripping and Vacuum Technology

Course Description
Robots remain an important part for automation and has increasingly played a vital role in improving process efficiency in manufacturing industry.

This course provides a good overview of the essential knowledge about robotic automation with gripping and vacuum technology where participants will be provided with a wide knowledge of fundamentals in handling technology ranging from various types of end effector elements to different types of robot systems.

Course Outcomes
Participants are able to
• Identify the different types of handling systems
• Describe the fundamentals of vacuum technology
• Describe the fundamentals of gripper technology
• Understand the mechanics behind robotics systems
• Describe the working principles behind the control of robot movement and speed
• Enunciate the principles of a motion control system
• Understand the mechanics behind collaborative robots
• Write, download and test robot programs

Course Contents
• Introduction to handling technology
• Handling with vacuum
• Handling with grippers
• Modular handling systems
• Industrial robots
• Collaborative robots
• Simulation and practical exercises

Course Duration – 32 hours

TCM-12 Fundamentals of Electric Drives and Electromechanical Systems

WSQ course - with SkillsFuture funding up to 70%

Course Description
This course will cover the fundamental knowledge and skill on the different electric motors and the electro-mechanical drives. Participants will also be able to incorporate the motors to the electrical drive units and how it is used in the industry.

Course Outcomes
Participants are able to
• Explain the functional principles of motors
• Describe the functional principles of servo and stepper motors and controllers
• Understand the difference between the various types of encoders and identify their function and specific application
• Analyse a system consisting of different electric drives, controllers, brakes, gear boxes and explain their configuration and relationship
• Differentiate between the various types of mechanical drives (axes), and explain their construction
• Select the most appropriate components of an electrical drive for a given application
• Explain the relevant parameters of the configuration software and their effect on the drive system
• Work safely with an electrical drive and demonstrate the desire to conform with safe practice

Course Contents
• Introduction to electrical motors
• Types of industrial motors: DC motors and AC motors
• Stepper motors
• Servo motors
• Electromechanical system
• Complete systems
• Simulation and practical exercises

Course Duration – 32 hours

In collaboration with

TRANZPLUS
A C A D E M Y

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GDI-11 Engineer Your Smart Factory Blueprint

Course Description

This is a Masterclass curated for the Singapore manufacturing industry. Participants will be introduced to the Smart Industry Readiness Index (SIRI), Prioritisation Matrix (PM), and various emerging and disruptive technologies. Industrial used cases and practical examples will be shared to illustrate the benefits of adopting state of art solutions for additive manufacturing, digital twins, energy monitoring, manufacturing execution system (MES), augmented and virtual reality etc. It is highly recommended that companies send in a cross functional team to attend this Masterclass.

Course Outcomes

Participants are able to
- Learn to identify company's maturity level and readiness using proven methodologies
- Evaluate existing process, technology and organisation
- Act on refining problem statements using design thinking principles
- Review the current state and frame problem statements with targeted Industry 4.0 focus areas
- Navigate and identify the right technology use cases based on business priorities, size of impact and organisational readiness

Course Content
- Fundamental of SIRI and PM
- Determine the aspirational state of the company guided by its business objectives
- Introduction to MES solutions packages
- Introduction to additive manufacturing solutions packages
- Introduction to energy monitoring solutions packages
- Introduction to digital twin and digital media technology such as augmented reality and virtual reality
- Introduction to TÜV SÜD and Siemens solution taxonomy

Course Duration – 24 hours

GID-11 Fundamentals of Industry 4.0 & Its Core Elements

Course Description

This course provides the fundamentals of industrial revolutions and the holistic perspective of the underlying concept of Industry 4.0 – a paradigm shift to the production of the future that integrates automation technology and information technology to enhance productivity, efficiency and flexibility in manufacturing processes.

Course Outcomes

Participants are able to
- Understand the development of industrial revolution towards Industry 4.0
- Identify the benefits of data-driven manufacturing process for flexible process design
- Recognise the opportunities for developing new business models and what to consider when implementing new strategies towards Industry 4.0
- Understand the important relationship between people, process, and technology to harness the full potential of Industry 4.0

Course Contents
- Fundamental concept of Industry 4.0
- Key differences between Industry 3.0 and 4.0
- Overview of the core elements and technologies of Industry 4.0
  - Radio Frequency Identification System
  - Human-Machine Interface, HMI
  - Machine-to-Machine M2M Communication
  - Vertical and Horizontal Integration
  - Augmented reality
- Demonstration of features and benefits of integrated automation with Industry 4.0 technologies
- Social-technological developments and the consequences
- Industry 4.0 implementation approach
- Industry 4.0-driven competency development and change management

Course Duration – 24 hours

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TUC-11 Flexible Manufacturing Process with Cyber-Physical System & Manufacturing Execution System

Course Description

Industry 4.0 is making paradigm shift in manufacturing towards future of production – the integrated automation with various technologies. The characteristics of the production of the future will become digitally networked throughout with data and connectivity.

This course provides an overview of the important characteristics of a Cyber Physical System and it aims to deliver the learning of the concepts of modularity and flexibility in manufacturing – concepts which are vital to increasing productivity and adaptability of the production configurations to meet the changing demands of the market requirements.

Practical implementation of a networked factory centrally controlled by the MES for production control, data collection and process analysis will be demonstrated.

Course Outcomes

Participants are able to
- Understand the basic technical concepts of the Cyber Physical System
- Understand the features & benefits of using MES to enable flexible configuration of manufacturing processes
- Learn the key concepts of using MES to optimise production control to enhance the flexibility of the production system.

Course Contents
- Characteristic of Cyber Physical System and the modularity & flexibility concept
- The basic features of MES such as order management, detailed planning and control, data collection, etc
- Using the MES to optimise production control
- Tracking the system performance with MES

Course Duration – 16 hours

TUD-31 Digital Twin for Advanced Digital Manufacturing

Course Description

Digital Twin enables you to visualise the asset, track changes, understand and optimise asset performance throughout the lifecycle of the product, predictive maintenance, and data-driven root-cause analysis resulting in improved efficiency.

This course aims to cover Digital Twin concepts that includes the virtual commissioning and optimisation of a factory layout, ergonomics, and validation of manufacturing concepts.

Participants will have the opportunity to design and develop digital twins to verify and optimise manufacturing processes and factory layouts in a 3D environment.

Course Outcomes

Participants are able to
- Understand the concepts of digital twin in the manufacturing industry and its application to product lifecycle management
  - Virtual commissioning
  - Optimisation
  - Digital thread, etc
- Understand future research trends and applications of digital twin-based systems
  - Data analytics

Course Contents
- Virtual design and commissioning of a factory layout
  - 3D design
  - Validation
  - Visualisation
  - Material flow logistics
  - Bottleneck analysis
  - Simulation driven planning and scheduling
  - Throughput analysis etc
- Design and verification of a manufacturing process in a 3D environment
  - Kinematic design and validation
  - Geometry validation and process-cell automation
- Human modelling and ergonomics.

Course Duration – 24 hours

In collaboration with

SIEMENS

TCD-31 Smart Manufacturing with RFID System

Course Description
Smart Manufacturing entails fully integrated & collaborative manufacturing system with high focus on data and seamless connectivity responding in real time the changing demand in the Smart Factory.

This course provides the fundamentals of RFID technology and how to use it to transfer data in production allowing flexible production configuration which contributes to flexibility & adaptability – a feature highly needed for lot size one production.

Course Outcomes
Participants are able to
- Understand the different identification methods such as binary code, QR code and RFID
- Identify the right identification method for the right application
- Integrate RFID to incorporate data into automation process driving towards Smart Manufacturing.
- Communicate data with RFID using Programmable Logic Controller

Course Contents
- Fundamentals of RFID
- Selection of RFID for different applications
- Benefits of using RFID to incorporate data into automation processes
- Programming the Programmable Logic Controller (PLC) to read data from the RFID tag
- Programming the PLC to write data to the RFID tag

Course Duration – 16 hours

TFS-31 Smart Sensor with IO-Link

Course Description
Sensors are the crucial component in one of the biggest trends in technology: the digital transformation. As the IIOT (Industrial Internet of Things) is now gathering momentum globally, sensors get smarter.

Many digital transformation solutions are simple implementations of smart sensor technology. Industry 4.0 workers need to understand this technology to reap its full benefits.

This course will get your plant or factory on the fast track to digital transformation by using the enhanced sensor features instead of paying for the costly development process and long implementation.

Course Outcomes
Participants are able to
- Understand the basics of smart sensors through a project-oriented exercise to integrate them in the automation processes.
- Know the operating principles and characteristics of the various types of sensors used in the manufacturing industry.
- Understand the benefits of smart sensors in the context of Industry 4.0 & able to setup and integrate them into different manufacturing processes to enhance operational efficiency such as predictive maintenance.
- Use the practical, easy-to-implement steps to make digital transformation a reality.
- Setup a sensor connection and communicate via IO-Link and Wireless connection
- Know the parameters of smart sensors for process optimisation and predictive maintenance.
- Make the job of the personnel easier by automatic data collection, monitoring, and interpretation using smart sensors.

Course Contents
- Smart sensor fundamentals
- Fundamentals and setup of IO-Link communication protocol
- Advantages of smart sensors over typical sensors
- Parameterisation and predictive maintenance
- Selection and easy replacement of sensors in the field
- Setup wireless monitoring and display dashboards
- Integrate smart sensors in different manufacturing processes
- Hands on simulation and practical exercises

Course Duration – 16 hours

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TCN-31 Industrial Ethernet with Profinet & OPC-UA for Industrial Automation

Course Description
The paradigm shift of manufacturing into data-driven automation puts strong emphasis of data connectivity between systems and devices driving towards a whole new dimension of networked automation.

PROFINET as one of the leading Industrial Ethernet standard which are widely used in the industry and OPC-UA, the internationally established communication standard for Industry 4.0 enables data exchange across all automation levels.

This course provides a good overview with hands-on practical exercises on the state-of-the-art learning equipment Modular Production System.

Course Outcomes
Participants are able to
• Understand the technology of PROFINET & OPC-UA for data communication in industrial automation
• Know the basics of industrial ethernet networking
• Use PROFINET protocol to control and monitor field devices
• Establish a machine-to-machine communication
• Carry out real time data access via OPC-UA

Course Contents
• The basics of industrial networking concept
• Overview and fundamentals of Industrial Network
• Fundamentals and components of a PROFINET network
• How to control field IO device via PROFINET
• Machine to Machine (M2M) Communication via PROFINET
• Fundamentals of OPC-UA
• Data access via OPC-UA

Course Duration – 16 hours

TUN-31 Node-Red Programming

Course Description
Node-Red is a flow-based development tool for visual programming using a pallet of nodes with built-in functionality that can be connected to other nodes for design applications.

This course provides basic knowledge of Node-Red and its application and teaches you how to use dashboard nodes to visualise data retrieved from a machine and the state-of-the-art training equipment Modular Production System will be used.

Course Outcomes
Participants are able to
• Understand the basic knowledge of Node-Red
• Setup communication between Node-Red and Programmable Logic Controller (PLC)
• Collect real-time data collection from the PLC with Node-Red
• Design dashboard for control and data visualisation

Course Contents
• Overview of OT and IT convergence
• Introduction of Node-Red
• Configuration and setup of flow-based development tool
• Familiarisation of flow-based programming
• Flow-based programming hands-on practical experience to visualise machine data with the use of the state-of-the-art training equipment Modular Production System

Course Duration – 24 hours

TUI-11 Enhance Work Efficiency with Augmented Reality (AR) & Virtual Reality (VR) Technology

Course Description
Interactive technology is gaining momentum in the manufacturing industry that people are embracing it to help increasing the efficiency in workplaces.

In this course, the Augmented reality (AR) and Virtual Reality (VR) are introduced to explore how they bridge the digital and physical worlds that allows workers to work more efficiently for the operation of production machinery.

Course Outcomes
Participants are able to
• Understand the fundamentals of AR and VR
• Know the differences and the application between AR and VR
• Enhance training effectiveness with the use of VR prior to actual operation on the production machinery
• Understand the benefits of using AR to increase process efficiency

Course Contents
• Fundamentals of AR/VR technology
• Benefit of AR/VR application in production environment to increase work efficiency
• Hands-on exercises to access information about production operation
• Considerations for AR/VR development

Course Duration – 8 hours

POL-11 LEAN Management and Industry 4.0

Course Description
Lean and Industry 4.0 are two philosophies with a similar target to achieve operational excellence. They complement each other to support the growing demand for high-mix low volume and mass customisation requirements for manufacturing. As digitalisation is raising new kinds of waste (especially in the area of data), new forms of analysing value streams are gaining importance.

This course provides an understanding of the connection between Lean Management and Industry 4.0, how Industry 4.0 can support the Lean approach concerning the challenges of small lot sizes and the requirement of product customisation.

Course Outcomes
Participants are able to
• Understand the underlying concept of digital transformation and the relationship between process, technology and people as the main building blocks of Industry 4.0
• Identify new opportunities for improvements in production by linking Industry 4.0 to Lean Management
• Understand and implement Value Steam Method/ Analysis 4.0 in the respective companies
• Learn from local SME how to start and sustain digital transformation

Course Contents
• Industry 4.0 – The industrial revolutions and the evolution of manufacturing paradigms
• The synergies of Industry 4.0 and Lean Management
• How to use Industry 4.0 elements to avoid typical kinds of waste
• Adaptation of a typical value stream analysis with digital components
• Study trip to local SME to learn how the adoption of Industry 4.0 and Lean Management increased the business performance of the company

Course Duration – 16 hours

In collaboration with

TRANZPLUS
A C A D E M Y

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GDA-11   SIRI Awareness

Course Description

The Smart Industry Readiness Index (SIRI) was created by the Singapore Economic Development Board (EDB) in partnership with a network of leading technology companies, consultancy firms, and industry and academic experts. SIRI comprises a suite of frameworks and tools to help manufacturers – regardless of size and industry – start, scale, and sustain their manufacturing transformation journeys. SIRI covers the three core elements of Industry 4.0: Process, Technology, and Organisation. Today, SIRI has been adopted internationally by both multinational corporations (MNCs) and small, medium enterprises (SMEs), with over 350 companies from more than 15 different countries having completed the Official SIRI Assessment (OSA). Learn more about SIRI from our certified SIRI assessor!

Course Outcomes

Participants are able to
- Explain the underlying principles of Industry 4.0
- Understand the aim of SIRI and the LEAD framework
- Identify the components of the SIRI Assessment Matrix framework
- Understand the TIER framework
- Identify the components of the Prioritisation Matrix framework
- Understand and appreciate SIRI through used cases in Singapore

Course Contents
- The what, why and how of Indudtry 4.0
- 3 building blocks, 8 pillars and 16 dimensions of the SIRI framework
- Translating concepts into real business value with the LEAD framework
- Key principles of the TIER framework for a holistic prioritisation
- Prioritisation Matrix framework as a management planning tool
- Case studies: Application of SIRI framework for early adopters

Course Duration – 8 hours
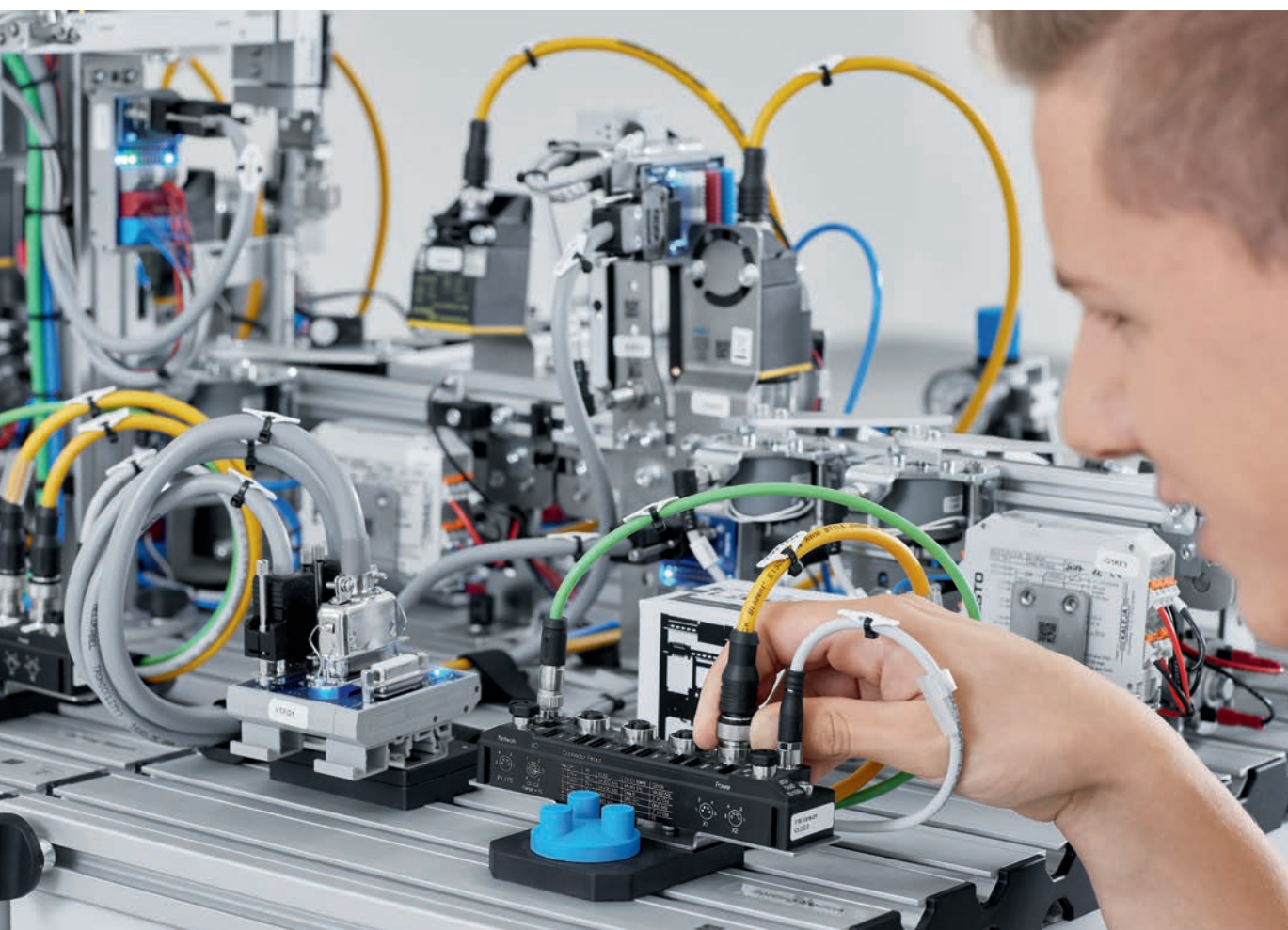
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SDIP   Specialist Diploma in Advanced Digital Manufacturing

TUM Asia recognises the value of academic industry partnerships and is working closely with industry leaders on executive training programmes in advanced manufacturing. In 2018, TUM Asia partnered Festo Didactic to launch Singapore's 1st Industry 4.0 Specialist Diploma in Advanced Digital Manufacturing.

Under the direct guidance of German experts who are the key drivers of Industry 4.0, the Specialist Diploma in Advanced Digital Manufacturing aims to equip participants with relevant Industry 4.0 knowledge and skills as well as hands on experience with state-of-art training equipment to prepare them for more complex job roles to meet new technological challenges in the advanced manufacturing industry. Participants can also receive expert mentorship to create and implement a digital transformation blueprint for their businesses to improve productivity and transform their operations.

The Specialist Diploma in Advanced Digital Manufacturing is a 280-hour programme and consists of six different modules that can be taken independently:
- ADM101 Essentials of Advanced Manufacturing Systems (40 hours)
- ADM102 Manufacturing Management (40 hours)
- ADM103 Advanced Manufacturing Project (60 hours)
- ADM201 Cyber Physical System (40 hours)
- ADM202 Industrial Internet of Things (40 hours)
- ADM203 Digital Manufacturing Project (60 hours)

Upon successful completion of each module, participants will be awarded with a modular certificate and the Specialist Diploma in Advanced Digital Manufacturing certificate will be awarded for full completion of the 6 modules.

The programme highlights include:
- Understanding the Smart Industry Readiness Index (SIRI)
- Workshops on additive manufacturing, collaborative robots and Lean 4.0
- Access to manufacturing execution system and digital twin software
- Local case study on Aquaculture 4.0 and indoor farming
- Site visit to Advanced Manufacturing Transformation Centre
- Site visit to Competence Centre for Digitalisation, Technology and Innovation
- Site visits to early adopters and hidden champions in Singapore

Offered by:

In partnership with:

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ESSENTIALS OF ADVANCED MANUFACTURING SYSTEMS   MANUFACTURING MANAGEMENT   ADVANCED MANUFACTURING PROJECT   CYBER PHYSICAL SYSTEM   INDUSTRIAL INTERNET OF THINGS   DIGITAL MANUFACTURwING PROJECT

ADM101 - Essential of Advanced Manufacturing Systems

Course Description

This 40-hour module is part of the Specialist Diploma in Advanced Digital Manufacturing. In this module, participants will be introduced to the global Smart Industry Readiness Index (SIRI) initiative and disruptive innovations in the advanced manufacturing sector. Industrial used cases and practical examples from local companies will be shared to illustrate how the adoption of disruptive innovations can help to augment production output.

This practical oriented module will be co-delivered by industry guest speakers from Siemens and TranZplus Academy.

Course Outcomes

Participants are able to
- Understand the underlying concepts of Industry 4.0
- Understand and apply the SIRI framework, Assessment Matrix and Prioritisation Matrix through practical used cases in Singapore
- Understand the fundamentals of additive manufacturing and its applications
- Understand robotic automation in production environments through practical-oriented training
- Understand the applications of AI and IoT monitoring through vertical farming
- Understand the use of industry strategy on fisheries management
- Identify the respective ecosystem partners of CDTI for practical implementations

Course Contents
- Understanding Industry 4.0
- SIRI framework, Assessment Matrix and Prioritisation Matrix
- Fundamental workshop on additive manufacturing
- Fundamental workshop on collaborative robot
- Site visit and workshop on vertical farming with disruptive technologies
- Case study on Aquaculture 4.0
- Site visit to Competence Centre for Digitalisation, Technology and Innovation (CDTI)

Course Duration – 40 hours

In collaboration with

ADM102 - Manufacturing Management Systems

Course Description

This 40-hour module is part of the Specialist Diploma in Advanced Digital Manufacturing. This module aims to equip modern manufacturing engineers and managers with deep insights on effective organisation of manufacturing processes. Participants will be introduced to topics such as digital value stream analysis, Lean 4.0, manufacturing execution system and enterprise resource planning system. In addition, participants will also have the opportunity to hear from a local SME on their digital transformation journey as an early adopter.

Course Outcomes

Participants are able to
- Understand the competencies and qualifications for Industry 4.0
- Understand flexible production with modular and reconfigurable product design
- Understand the fundamental approaches to the configuration of a supply chain
- Understand the planning systems to shape the future as a supply chain manager
- Understand the process and applications of digital factory planning
- Understand and apply digital value stream analysis through practical examples
- Understand the opportunities of digitalisation in Lean Management
- Experience and understand the digital transformation journey of an early adopter

Course Contents
- From technology to management
- Product service development
- Demand and supply network
- Configuration on planning systems (i.e. MRP and ERP)
- Factory and facility planning
- Industry 4.0 meets Lean Management
- Site visit to local SME

Course Duration – 40 hours

In collaboration with

TRANZPLUS ACADEMY

ADM103 - Advanced Manufacturing Project

Course Description

This 60-hour module is part of the Specialist Diploma in Advanced Digital Manufacturing and provides the holistic perspective of the underlying concept of Industry 4.0 and its underpinning core elements of Organisation, Technology and Process - the paradigm shift to the production of the future with integrated automation to enhance productivity, efficiency, and flexibility in manufacturing processes.

Participants will learn the steps for implementing Industry 4.0 and the application of technology such as Manufacturing Execution System (MES), RFID, OPC-UA, smart sensor & augmented reality in the practical way.

Course Outcomes

Participants are able to
- Grasp the underlying concepts of Industry 4.0
- Understand the important relationship between Organisation, Process, and Technology to harness the full potential of Industry 4.0
- Identify the benefits of data-driven manufacturing process for production flexibility
- Identify the key differences between Industry 3.0 and Industry 4.0
- Understand the steps in Industry 4.0 implementation
- Recognise the potential of Industry 4.0 implementation for new business models

Course Contents
- Fundamental concept of Industry 4.0 and the underpinning core elements
- Key differences between Industry 3.0 and 4.0
- Integrated automation with Industry 4.0 technologies
  - Manufacturing Execution System
  - Radio Frequency Identification System
  - Machine-to-Machine M2M Communication and OPC-UA
  - Smart sensor and its application
  - Augmented reality
- Incorporate data in the automated system enabling smart manufacturing process
- Industry 4.0 implementation approach
- Industry 4.0-driven competency development and change management
- Group work of Advanced Manufacturing Project

Course Duration – 60 hours

ADM201 - Cyber Physical System (CPS)

Course Description

This 40-hour module is part of the Specialist Diploma in Advanced Digital Manufacturing and provides the overview of the characteristics and components of a Cyber Physical System (CPS) and how it can form an important part of Industry 4.0.

The participants will learn the theory on computation and communication platform architectures for automation and the RAMI 4.0, ISA-95 and the OSI Layer model. The concept of the convergence between the Information Technology (IT) and Operation Technology (OT) will also be covered to see how it brings the automation system to another level of intelligence with a new dimension of unprecedented connectivity.

Course Outcomes

Participants are able to
- Understand the fundamentals of CPS
- Identify the key elements of a CPS
- Understand the interlink between the communication network and the physical system
- Differentiate between an embedded system, control system and a CPS
- Understand the implication of a CPS for Advanced Digital Manufacturing

Course Contents
- Introduction to CPS – an important characteristic of Industry 4.0
- Elements of CPS and its importance for a smart production system
- Communication networks and the physical systems within a single entity
- Overview of technologies enabling connectivity, open communication protocols, and cooperation between systems in the highly digitalised manufacturing environment
  - Sensors and data analytic
  - Networking protocols
  - IIOT
- The essentials of the digital representation of the networked Cyber Physical System
- CPS for Advanced Digital Manufacturing
- Case studies and discussions

Course Duration – 40 hours

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ADM202 - Industrial Internet of Things

Course Description
This 40-hour module is part of the Specialist Diploma in Advanced Digital Manufacturing and it covers various aspects of Internet of Things (IoT) that leads to the development of skills and experiences employed in designing novel industrial IoT systems.

Course Outcomes
Participants are able to
• Grasp the underlying concepts of Industry 4.0
• Understand the underlying concepts of IoT and their applications through case studies
• Understand the definitions of IoT and IIoT, their relation to Industry 4.0 and the Industrial Internet Reference Architecture (IIRA)
• Understand and apply IoT communication protocols (e.g. MQTT) and interaction pattern
• Understanding the role and importance of service-oriented architectures (SoA) and systems of systems in IIoT
• Understand the applications of artificial neural network and machine learning for online quality control, condition monitoring and predictive maintenance
• Appreciate IIoT induced supply chains and business models
• Design concepts for IIoT in supply chain management
• Design concepts for IIoT and product lifecycle management

Course Contents
• Fundamentals of IoT and IIoT
• IoT communication protocols and service-oriented architectures
• Semantic web technologies and their applications in IIoT
• Basics of artificial neural networks and machine learning
• IIoT business prospective
• IIoT in supply chain management and product lifecycle management

Course Duration – 40 hours

ADM203 - Digital Manufacturing Project

Course Description
This 60-hour module is part of the Specialist Diploma in Advanced Digital Manufacturing and provides the practical aspects of the important characteristic of a Cyber Physical System (CPS). The state-of-the-art learning equipment called the Cyber Physical Factory will be used to facilitate the learning of creating a digital representation of the production system, the concept of modularity, flexibility that are vital to increasing productivity and adaptability of the production configurations to meet the changing demands of the market requirements.

Participants will be working on the Cyber Physical Factory with hands-on exercises using both the Manufacturing Execution System (MES) and Digital Simulation Software in combination.

Course Outcomes
Participants are able to
• Understand the benefits of modular design of the CPS enabling high flexibility in production configuration
• Control and monitor production system with MES
• Create digital representation of the physical system
• Analyse and optimise the system configuration digitally to maximise productivity and efficiency prior to actual physical implementation

Course Contents
• Modular and flexible design of a CPS
• Data communication and networking structure of the CPS
• Hands-on exercises on the networked system (CPS) centrally controlled by MES
• The basic features of MES such as order management and detailed planning
• Using the MES to optimise production operation and track the system performance
• Development of digital representation of the physical system
• IIoT application
• Group work of Digital Manufacturing Project

Course Duration – 60 hours

Reasons to join Specialist Diploma in Advanced Digital Manufacturing

Learn from German Experts

Uprade your skills and learn from the key drivers of the industry 4.0

Hands-on Experience with Equipment

State-of-the-art Industry 4.0 training equipment during project modules

Post-Training Mentorships

Customised guidance to apply new solutions to the organisation

1st Industry 4.0 Specialist Diploma

First of its kind of being offered in Singapore with more than 60 graduates

Quality Instructional Time

Focus on one module at a time with our block teaching system

Up to 70% Funding

SkillsFuture funding available for Singapore and Permanent Residents (PR)

Application information for Specialist Diploma in Advanced Digital Manufacturing

Who Should Attend

Professionals in the following or related fields:
- Automation
- Electrical/Electronics
- Mechatronics
- Information Technology
- Infocomm
- Science & Technology

Individuals interested in:
- Advanced Digital Manufacturing

Admission Requirement

A Bachelor's degree (or higher), OR a relevant polytechnic diploma with at least 2 years of related working experience

Applicants who do not meet the entry requirements may be considered based on:
(i) Evidence of at least 5 years of relevant working experience; OR
(ii) Supporting evidence of competency readiness
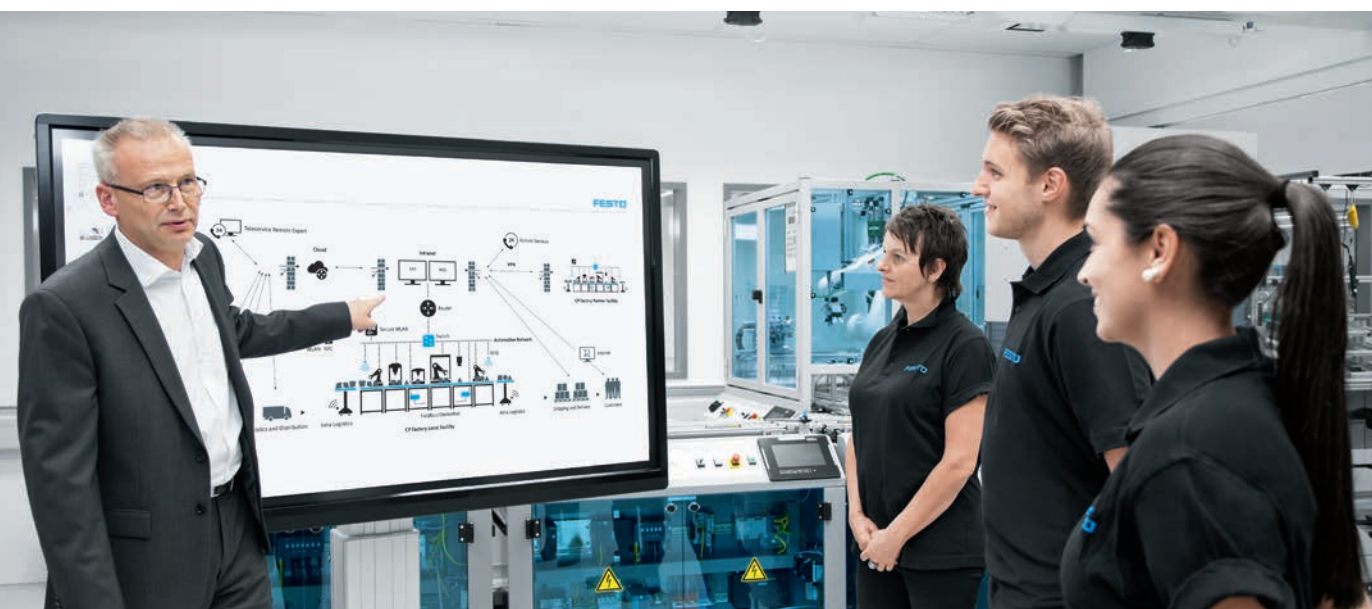

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I4ST   Industry 4.0 Specialist Training Programme in support with AHK (German Chamber of Commerce)

Industry 4.0 describes a paradigm shift in manufacturing for Factory of Future (FoF) and often referred to as the Smart Factory – a factory enabled with data and connectivity to enhance the flexibility and adaptability of production systems to respond quickly to the changing demands of the market.

It is not only changing the future of manufacturing, but also affecting the organisation and the employees with changing job profiles and new business models. Therefore, qualification for Industry 4.0 becomes a key success factor for industrial companies.

The Industry 4.0 Specialist Training Programme is offered by Festo Didactic and Technical University of Munich (TUM) Asia with Malaysian-German Chamber of Commerce and Industry (MGCC) as the German certification body by following the standards of the Association of German Chambers of Industry and Commerce (DIHK). The objective is to offer a certification in the certification corridor - local dual training with elements of the German system.

Industry 4.0 Specialist Training Programme consists of 5 training modules with holistics perspectives:
- Understanding Industry 4.0 (8 hours)
- Networked Business Models in Production and Logistics (32 hours)
- Technologies for Implementing Industry 4.0 (24 hours)
- Work and Organisation Design in the Age of Digital Transformation (24 hours)
- Final Assessment (8 hours)

In collaboration with

Course Objective

The aims of the course are to train the workforce in the industry with the knowledge and skillsets to assist them on the digital transformation journey of the company to drive increased productivity and efficiency. As a result, enhancing business competitiveness and sustainability.

The course focuses on enabling participants to take the next steps towards Industry 4.0 implementation:
- Understanding the underlying concepts of Industry 4.0
- Recognise the potential of Industry 4.0 and develop implementation in logistics and production
- Specific examples on Industry 4.0 applications from different production areas
- Agile approach adapting to dynamic work situation and environment

Module 1	Module 2	Module 3	Module 4	Module 5
Understanding Industry 4.0	Networked Business Models in Production and Logistics	Technologies for Implementing Industry 4.0	Work and Organisation Design in the Age of Digital Transformation	Final Assessment

Module 1: Understanding Industry 4.0

Course Description

Industry 4.0 describes a fundamental change in the world of production. Modern information and communication technologies are merging with classic industrial processes to form the so-called Cyber Physical System. Driven by the Internet, the real and virtual world are increasingly growing closer together. This module will introduce the key concepts of Industry 4.0 and the driving technologies for the convergence of digital and physical worlds

Course outcome

Participants are able to understand the underlying concept of digital transformation and the core technologies of industry 4.0

Course Contents
- Development of the industrial revolution
- Overview of the core elements
- Manufacturing Execution System (MES)
- Product identification with radio frequency identification RFID system
- Vertical and horizontal integration
- Machine to machine communication
- Fundamental of industrial network technology
- Worker assistance with augmented reality

Course Duration – 8 hours

Module 2: Networked Business Models in Production and Logistics

Course Description

The business operations of companies are increasingly influenced by the introduction of the Industry 4.0 technologies, hence the basic understanding of how these technologies change the way of interactions between people, machines and processes are essentials. These are crucial for enabling optimal business performance of companies.

Basic knowledge about networked business models, B2B platforms and networked production solutions will be explained to illustrate the relationships of one or more supply chains in the environment of Industry 4.0.

Course outcome

Participants will become aware of the fundamentals of networked business model in production and logistics, learn to appreciate the benefits of the digitalisation of logistics and supply chains, and adopt suitable transformation initiatives within their organisations.

Course Contents
- Enabling technologies for networked business models and production solutions
- Technical framework conditions of component labelling in networked production and logistics solutions
- Existing business models
- Fundamental conditions of data transfer
- Fundamentals of supply chains and supply chain management
- Digitalisation of logistics and supply chains
- Logistics and Industry 4.0
- State-of-the-art technologies
- Real world application
- Working in a network in the digital supply chain

Course Duration – 32 hours

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Module 3: Technologies for Implementing Industry 4.0

Course Description
Overview of basics of technologies (machine controls, sensors, gateways / connectors, user interfaces, etc) which are used in the Industry 4.0 environment and the important characteristics of a Cyber Physical System. It aims to deliver the learning of the concepts of modularity and flexibility in manufacturing – concepts which are vital to increasing productivity and adaptability of production configurations to meet the changing demands of the market requirements. Practical implementation of a networked factory centrally controlled by the Manufacturing Execution System (MES) for production control, data collection and process analysis will be demonstrated.

Course Outcomes
Participants are able to understand the features & benefits of industry 4.0 technologies that enable flexible configuration of manufacturing processes and optimisation of production control and planning.

Course Contents
- Overview of the technologies used in Industry 4.0 environment
- Sensors, actuators, processors and HMI of a Cyber Physical System
- Modularity and flexibility concept of the Cyber Physical System and its characteristics
- Manufacturing Execution System (MES) and its benefits for production management
- Digital simulation and modelling of Cyber Physical System with digital simulation software CIROS
- Explanation & practical demonstration of digital simulation (CIROS) for production control on the Cyber Physical System

Course Duration – 24 hours

Module 4: Work and Organisation Design in the Age of Digital Transformation

Course Description
The increasing automation in production facilities & the introduction of Industry 4.0 technologies unshackle workers from mundane shop-floor tasks to new job roles and responsibilities allowing them to spend more time on higher-value activities such as monitoring datasets for the implementation of preventive maintenance regimes. More importantly, how organisations evolve their business operations involving the new way of interactions between people, machines and processes in this digital era.

Course Outcomes
Participants are able to
- Understand the relationships between the main building blocks of human, technology and processes in the context of Industry 4.0
- Understand Change Management challenges at all the levels of the organisations and the application of Agile method with SCRUM & Kanban

Course Contents
- Social-technological developments and the consequences
- Competence development for Industry 4.0
- Change Management for Industry 4.0
- The Agile values and guiding principle
- The methodologies of SCRUM and Kanban
- Organisation transformation case studies

Course Duration – 24 hours

Module 5: Final Assessment

Course Description

The assessment serves as the qualification for an Industry 4.0 Specialist (MGCC). It is intended to facilitate and enable the participants to acquire the required knowledge and skills so that they are able to develop and implement targeted solution for digital transformation project for the company. The final stage of the qualification involves completing a final assignment which includes oral examination, project presentation and a final project report.

Course Contents
- Multiple choice examination questions
- Homework-based assignment
- Oral examination
- Presentation of homework-based assignment

Course Duration – 8 hours

Digital Transformation Programme

TUO-11 Paradigm Shift towards Digitalisation

Course Description

In this course, it provides the exploration of the profound positive impact of digitalisation on the way manufacturing competes, improves efficiency, and boosting the speed of time-to-market for products and services.

Participants will learn the holistic view of digital transformation process and the concrete steps to be taken – a step-by-step approach that gives the essential understanding for a successful adoption of Industry 4.0 concept towards business transformation.

Course Outcomes

Participants are able to
- Understand the digital transformation process in the practical way
- Understand the benefits of digitalisation for manufacturing productivity and efficiency
- Embrace the combined benefits of IT and OT for smart manufacturing practices
- Understand the importance of vertical and horizontal integration for an immersive business process flow
- Differentiate the various stages of digitalisation process
- Identify essential manual manufacturing processes to be digitalised
- Understand how real-time production data is used at higher organisational levels when making decisions.
- Understand how to retrofit sensors for predictive maintenance and condition monitoring.

Course Contents
- Overall digitalisation strategy for business resilience and sustainability in manufacturing
- Digitalisation process with Manufacturing Execution System (MES) in the practical way
- Conversion from an automated production line to data-driven automated production line
- The concept of IT and OT convergence
- Vertical and Horizontal Integration
- Utilising digital technology for visibility on machine and business operation
- Use of production data between systems for lower production cost and reduced wastages
- Data-driven business insights

Course Duration – 8 hours

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TUM-11   Digitalising Operation with Manufacturing Execution System (MES)

Course Description
This course will provide walk through exercises on digitalising manufacturing operations of a traditional factory to offer manufacturers the visibility, management, and process optimisation to boost efficiency. Learn how to start a digitalisation journey with an easy to use, commercially available Manufacturing Execution System (MES) software.

Participants will get to use MES to plan, execute, and monitor operations on the plant or factory floor to gain access to digital data, workflows, workstation control, quality, inventory, and reports.

Course Outcomes
Participants are able to
- Understand the features and benefits of MES for digitalisation
- Use MES to convert manual-based works to digital workflow
- Create simple manufacturing dashboard for monitoring and visualisation
- Use MES to track sales order information and manage resources more effectively
- Identify essential manual manufacturing processes to be digitalised

Course Contents
- Fundamentals of Manufacturing Execution System (MES)
- Advanced Production Planning & Scheduling
- Digitalisation process with MES
  - Creating digital process workflow
  - Creating sales order, work order & scheduler
  - Creating asset and resource management
  - Designing simple dashboards
  - Generating job reports
  - Managing and monitoring inventory
  - Tracking production order status
  - Digitalising line maintenance and support

Course Duration – 16 hours

TAV-31   Vertical Integration with Seamless Connectivity

Course Description
This course will allow participants to learn and use a commercial Manufacturing Execution System (MES) software with practical exercises on real-time tracking, predictive maintenance and detailed data driven analysis of production processes.

With practical exercises, participants will use the open communication standard to exchange data between existing production system and MES enabling information flow via interconnectivity structure.

Course Outcomes
Participants are able to
- Use MES to connect to machines for optimised operational visibility & efficiency in the practical way
- Create simple manufacturing dashboard for monitoring and visualisation
- Transfer business information to the factory floor enabling flexible production configuration
- Integrate appropriate sensors to collect machine data for condition monitoring, predictive maintenance and digital maintenance without affecting the existing system

Course Contents
- Vertical integration for seamless data flow between MES and machine controller (PLC)
- Creating dashboard for remote and real-time production monitoring and visualisation
- Flexible manufacturing with adaptable production configuration.
- Overall Equipment Efficiency (OEE) status monitoring
- Condition Monitoring and Predictive Maintenance
- Remote access of alarm and events

Course Duration – 24 hours

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TUH-31 Horizontal Integration for Optimal Business Efficiency

Course Description
This course is a carefully guided process to enhance a simulated business operation by integrating Enterprise Resource Planning (ERP) system to organisation's supply chain and customers.

Participants will develop an inter-company value chains and networks through horizontal integration.

The use of the Modular Production System (MPS) will give participants practical practice and skills to achieve the end to end digitalisation objective between factory floor and ERP.

Course Outcomes
Participants are able to
- Understand the underlying concept of horizontal integration for increased overall business operational visibility & efficiency in the practical way
- Link MES with ERP to enhance the resource management for optimised business process flow
- Know how to leverage with e-commerce to expand manufacturing capabilities.
- Understand the use of inter-operable communication protocols between different systems from different manufacturers

Course Contents
- Fundamentals of ERP system for resource management
- Horizontal integration with business processes – linking MES with ERP for optimised work order
- Convergence of IT and OT for overall business efficiency and productivity
- Create dashboard for remote and real-time order monitoring and visualisation
- Integrate ERP to web shop for increased business profitability & sustainability
- Use of production data between systems for lower production cost and reduced wastages

Course Duration – 24 hours

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General Information

Enquiry

For registration, general information and customisation of training courses, please contact us

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Or visit cdti.com.sg

Withdrawal

Any request for withdrawal must be made in written and received at least 3 working days before course commencement date.

Workforce Skills Qualification courses

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

WSQ Courses are eligible for Workfare Skills Support (WSS Scheme) and Mid-Career Enhanced Subsidy (MCES).

Subsidy Type		
Normal		Mid-Career Enhanced Subsidy (MCES)
Employer sponsored	Self-sponsored	
Singapore Citizens (SCs) aged ≤ 39 years / Singapore Permanent Residents (PRs)	Singapore Citizens (SCs) aged 21 years to 39 years / Singapore Permanent Residents (PRs) aged ≥ 21 years	Employer / self-sponspored Singapore Citizens (SCs) aged ≥ 40 years

For more details, please visit
https://www.ssi.gov.sg/training/funding-information/skillsfuture-singapore-funding/
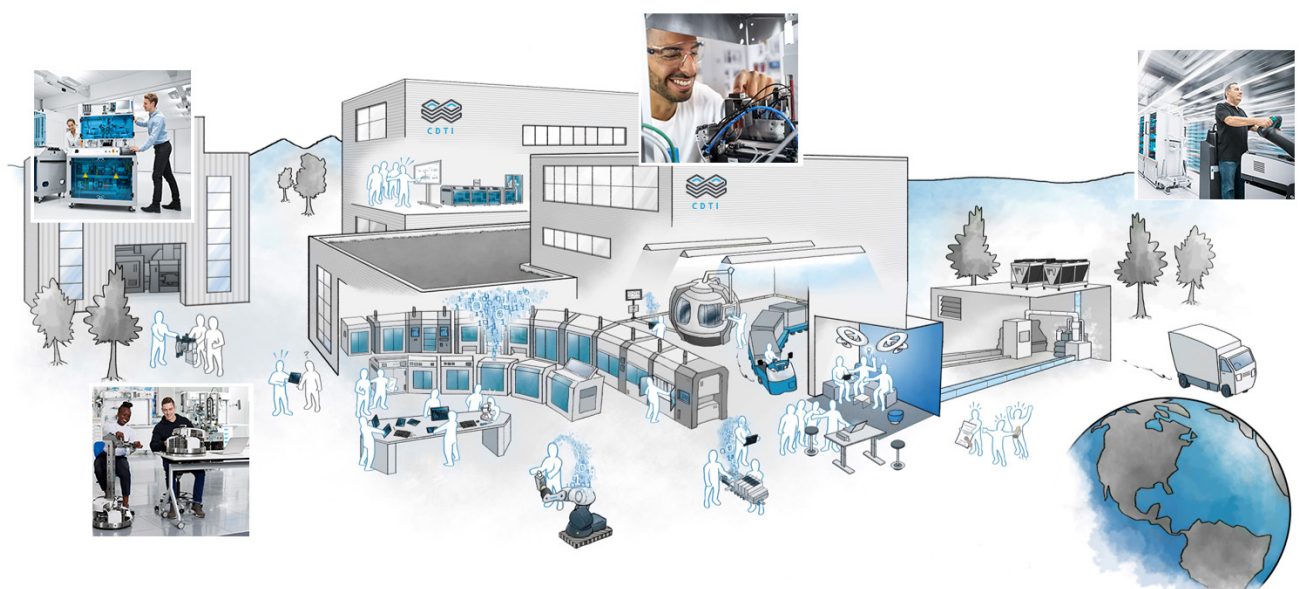
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* Information is accurate at time of print (August 2021)