MANUFACTURING AND ENGINEERING TECHNOLOGY

Optoelectronic Technology

WorldSkills Occupational Standards

 WSC2021_WSOS60_Optoelectronic_Technology

WorldSkills Occupational Standards (WSOS)

Occupation description and WSOS

The name of the occupation is

Optoelectronic Technology

Description of the associated work role(s) or occupation(s)

Optoelectronics is a branch of Photonics (the physical science of light). Optoelectronics combines the physics of light with electricity. Optoelectronic technology covers the design, manufacture and manipulation of hardware that converts electrical signals into photon signals and vice versa. Any device that does this can be referred to as optoelectronic.

Optoelectronics is a broad and fast developing field, defined by its:

- Products: for example, lighting, display, for communication and information, sensors, photovoltaic systems, and lasers
- Applications: such as research, automation, medical treatment, engineering, construction, security, advanced manufacture, detection, and measurement.
- Occupations: covering work roles at all levels of complexity and responsibility.

This Description focuses on the occupational requirements of an optoelectronic (engineering) technician or associate professional. These personnel must work with accuracy and precision, meet detailed specifications and international quality standards, and have a wide range of technical capabilities. With the increase of energy-saving requirements and intelligent equipment, optoelectronic technicians need actively to ensure that their skills and knowledge remain up-to-date and meet industry standards and expectations.

Optoelectronic technicians work directly and indirectly with and for customers, so must communicate with them, and serve them well. They must explain complex optoelectronics straightforwardly and help clients to use systems and products correctly. The nature of their work generally requires total respect for confidentiality, together with integrity, honesty, and a strong sense of ethics.

In their scope of work, optoelectronic technicians may be involved in one, two, or all three stages of production, maintenance, and development, depending on the sector, size, and position of the employing organization, in the market or a supply chain.

- First, these technicians are engaged in the design, development, and manufacture of new devices or equipment, in either a leading or supporting role, depending on the scale and complexity of the commission. In this role they must work with optical, electrical, magnetic, and mechanical systems. They should also be able to use optoelectronic related software to assist their work.
- Second, these technicians will install, commission, and maintain optoelectronic systems, which are complex and vulnerable, for both their operation and their quality, to the impacts of humidity, vibration, field intensity, and ground connections. They must be very familiar with equipment's interior structure. They are generally responsible for ongoing maintenance, repair, and development.
- Third, these technicians may be involved in quality control, testing, analysis, optimization, and reporting. As environmental concerns increase, and change accelerates with new technologies, this element of the role is expected to grow in importance. Optoelectronic technicians use specialist tools, including measurement and test equipment, and bespoke software.

There are many employment opportunities for optoelectronic technicians, as self-employed freelancers or entrepreneurs, with product agents and engineering companies, and elsewhere. This is a fast-growing field of

employment, within which the exceptional technician can have either broad or deep expertise, and use this to advance rapidly as optoelectronics expands in importance and demand.

General notes on the WSOS

The WSOS specifies the knowledge, understanding, and specific skills that underpin international best practice in technical and vocational performance. It should reflect a shared global understanding of what the associated work role(s) or occupation(s) represent for industry and business (www.worldskills.org/WSOS).

The skill competition is intended to reflect international best practice as described by the WSOS, and to the extent that it is able to. The Standard is therefore a guide to the required training and preparation for the skill competition.

In the skill competition the assessment of knowledge and understanding will take place through the assessment of performance. There will only be separate tests of knowledge and understanding where there is an overwhelming reason for these.

The Standard is divided into distinct sections with headings and reference numbers added.

Each section is assigned a percentage of the total marks to indicate its relative importance within the Standards. This is often referred to as the "weighting". The sum of all the percentage marks is 100. The weightings determine the distribution of marks within the Marking Scheme.

Through the Test Project, the Marking Scheme will assess only those skills that are set out in the Standards Specification. They will reflect the Standards as comprehensively as possible within the constraints of the skill competition.

The Marking Scheme will follow the allocation of marks within the Standards to the extent practically possible. A variation of up to five percent is allowed, provided that this does not distort the weightings assigned by the Standards.

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Section		Relative importance (%)
1	**Work organization and management**	**10**

The individual needs to know and understand:

- Health and safety legislation, obligations, and documentation
- The principles of working safely with electricity, electronics, and lasers
- The situations when personal protective equipment (PPE) must be used
- The purposes, uses, care, maintenance, and storage of all tools and equipment together with their safety implications
- The purposes, uses, care, and storage of materials
- The importance of keeping a clean and tidy work area
- Sustainability measures applying to the use of 'green' materials and recycling
- The ways in which working practices can minimize wastage and help to manage costs whilst maintaining quality
- The principles of workflow and measurement
- The significance of planning, accuracy, checking, and attention to detail in all working practices
- The impact of new technology

The individual shall be able to:

- Apply and follow Health, Safety, and Environmental standards, rules, and regulations
- Diligently follow electrical safety procedures
- Identify and use the appropriate personal protective equipment (PPE) including safety footwear, ear, and eye protection
- Select, use, clean, maintain, and store all tools and equipment safely
- Select, use, and store all materials safely
- Identify and take particular care of expensive or vulnerable fixtures/fittings
- Plan the work area to maximize efficiency and maintain the discipline of regular tidying
- Measure accurately
- Manage time effectively
- Work efficiently and check progress and outcomes regularly
- Establish and consistently maintain high quality standards and working processes

Section		Relative importance (%)
2	**Communication and interpersonal skills**	5

The individual needs to know and understand:

- The significance of establishing and maintaining customer confidence and trust
- The importance of maintaining and keeping one's knowledge base up-to-date
- The roles and requirements of related trades
- The value of building and maintaining productive working relationships
- Principles and techniques of effective teamwork
- The importance of swiftly resolving misunderstandings and conflicting demands

The individual shall be able to:

- Interpret customer requirements and manage customer expectations positively
- Provide advice and guidance on products/solutions, such as technological advancements
- Create training materials according to the construction of each system, and implement training
- Create training content and related materials for optoelectronic applications
- Visualize and translate customer wishes, making recommendations which meet/improve their design and budgetary requirements
- Question customers closely/deeply to fully understand requirements
- Provide clear instructions
- Introduce related trades to support customer requirements
- Produce written reports for customers and organizations
- Produce cost and time estimates for customers
- Recognize and adapt to the changing needs of related trades
- Work effectively as a member of teams

3	**Design and manufacturing of optoelectronic applications**	20

The individual needs to know and understand:

- Principles of optics, electrical and mechanical theory
- The various optoelectronic specialisms within specific industries
- Commonly used and International industry standard symbols
- The photovoltaic effect
- The application environment of optoelectronics
- Design schemes of optoelectronic applications
- The characteristics and operating principles of various optoelectronic applications (such as photovoltaic products, LED lamps, optoelectronic transmission equipment, optoelectronic and display equipment, sensors, and laser systems)

Section	Relative importance (%)
• The characteristics of appropriate control equipment, photovoltaic power generation equipment, sensors, laser systems, optoelectronic application terminals, controls, or control platforms, for integrated applications • The possibilities to test parameters of optical and electronic components or optoelectronic products • How to select optical and electronic components • The drive and heat dissipation and configuration of optoelectronic applications. • The manufacturing specification for optoelectronic products • How to utilize optoelectronic related software to assist their work	
The individual shall be able to: • Analyse the important parameters and functional requirements of the application environment • Inspect the manufacturing and quality of optoelectronic applications • Complete the production and quality inspection of optical and electronic components with high efficiency and high quality • Test and select correct specifications for various optoelectronic applications (such as photovoltaic products, LED lamps, optoelectronic transmission equipment, optoelectronic display equipment, sensors, and laser systems.) • Select appropriate control equipment, photovoltaic power generation equipment, sensors, laser systems, optoelectronic application terminals, controls, or control platforms, for integrated applications to achieve energy-saving and efficient goals • Analyze the application environment of optoelectronic application products • Select and optimize manufacturing schemes for optoelectronic application terminals • Select and optimize energy-saving and light efficiency design schemes • Select application models of optical and electronic components • Test the function and performance parameters of optical and electronic components or optoelectronic products • Configure the drive and heat dissipation modules of optoelectronic application products • Test the function and performance of optoelectronic application products • Utilize optoelectronic related software to assist their work	

Section		Relative importance (%)
4	**Installation and Implementation of optoelectronic applications**	35

The individual needs to know and understand:

- Basic principles of optics, electronics, and mechanics
- Basic principles and techniques for photoelectronic applications
- The application environment for optoelectronic applications
- Engineering drawings, wiring diagrams, schematics, technical manuals, and engineering instructions
- The composition of optoelectronic applications
- The requirements of optoelectronic applications
- How to analyze requirements of optoelectronic applications
- How to select optoelectronic application schemes
- Select appropriate electronic common tools and optoelectronic specific instruments or tools to complete their work.

The individual shall be able to:

- Read and interpret engineering drawings, wiring diagrams, schematics, technical manuals, and engineering instructions
- Analyse customer requirements for optoelectronic system applications
- Select appropriate optical and electronic components' efficiency design schemes according to applications' needs
- Analyse their functions and key characteristic parameter requirements
- Select appropriate optical and electronic components according to the characteristics of the optoelectronic applications
- Test relevant parameters according to the characteristics of each optoelectronic application
- Test the characteristics of various sensors, laser systems and other control devices
- Select suitable optoelectronic applications scheme according to demand analysis
- Select and configure the correct drive and heat dissipation modules according to the optoelectronic applications terminal structure and power parameters, and deal with their processing technology
- Provide system structure drawings, construction drawings, and related materials
- Put equipment, components, devices, upgrades, or refurbished equipment into use
- Use a variety of optoelectronic display devices, and optoelectronic transmission equipment, such as sensors and photovoltaic power generation equipment
- Select flexibly energy-saving control methods
- Select and test the characteristics of optoelectronic application equipment
- Select, test, and use the optoelectronic application system control platform
- Test the characteristics of various sensors and other control devices
- Install and debug the optoelectronic application system
- Complete system installation and debugging according to construction drawings, and provide corresponding test reports

Section		Relative importance (%)
	• Use electronic common tools and optoelectronic specific instruments or tools, such as electric soldering irons, digital multi-meters, and chroma meters.	
5	**Maintenance of optoelectronic applications**	**20**
	The individual needs to know and understand: • Construction drawings and technical data of optoelectronic applications • The relevant industry standards of maintenance • The use of optoelectronic industrial materials and tools for general maintenance, installation, and maintenance tasks • Construction drawings for optoelectronic applications • Fault detection methods for optoelectronic application systems • Optoelectronic application systems maintenance and functional testing	
	The individual shall be able to: • Read the drawings and documents for optoelectronic application systems • Analyse the working principles of the optoelectronic applications, the transmission process of the signals, and the characteristic parameters of each link • Analyse the causes of each fault, decide on a fault detection scheme, and make detections according to the fault phenomena • Repair or replace faulty equipment and lines in optoelectronic applications • Replace components and cables • Use standard optoelectronic testing tools, instruments, and maintenance tools • Maintain each module of optoelectronic application systems • Modify control platform parameters • Debug and optimize optoelectronic application systems • Test optoelectronic applications after maintenance • Manipulate optoelectronic applications.	
6	**Optimization of optoelectronic applications**	**10**
	The individual needs to know and understand: • How to achieve energy saving to a greater extent, within the applicable demand parameters • How to optimize optoelectronic application schemes • The principle of optimizing driving and heat dissipation of optoelectronic products • How to optimize the design of optoelectronic products • The principle of light efficiency design for optical and electronic components of optoelectronic products • Energy consumption management of optoelectronic application systems • Control principles of optoelectronic application systems • How to use related software to assist their work	

Section	Relative importance (%)
The individual shall be able to: • Make appropriate optimizations • Select and optimize each application scheme of optoelectronic systems • Achieve energy saving within various requirements and parameters • Optimize the heat dissipation performance of optoelectronic products • Design the structures of optoelectronic products • Optimize the driving circuits of optoelectronic products • Improve the user experience of optoelectronic products • Design light efficiency schemes relating to optical and electronic components • Improve the conversion efficiency of photovoltaic systems • Reduce the energy consumption of optoelectronic application systems • Design energy saving strategies for optoelectronic application systems • Design light shows • Design intelligent lighting systems. • Use related software to simulate different application scenes and optimize optical and electronic components' configuration.	
Total	**100**

References for industry consultation

WorldSkills is committed to ensuring that the WorldSkills Occupational Standards fully reflect the dynamism of internationally recognized best practice in industry and business. To do this WorldSkills approaches a number of organizations across the world that can offer feedback on the draft Description of the Associated Role and WorldSkills Occupational Standards on a two-yearly cycle.

In parallel to this, WSI consults three international occupational classifications and databases:

- ISCO-08: (http://www.ilo.org/public/english/bureau/stat/isco/isco08/)
- ESCO: (https://ec.europa.eu/esco/portal/home)
- O*NET OnLine (www.**onet**online.org/)

The following table indicates which organizations were approached and provided valuable feedback for the Description of the Associated Role and WorldSkills Occupational Standards in place for WorldSkills Shanghai 2022.

There were no responses to the requests for feedback this cycle