

TRAINING REGULATIONS



SEMICONDUCTOR FRONT-OF-LINE (FOL) OPERATIONS NC II

ELECTRICAL & ELECTRONICS SECTOR

TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY
East Service Road, South Luzon Expressway, Taguig City, Metro Manila

Technical Education and Skills Development Act of 1994
(Republic Act No. 7796)

Section 22, “Establishment and Administration of the National Trade Skills Standards” of the RA 7796 known as the TESDA Act mandates TESDA to establish national occupational skills standards. The Authority shall develop and implement a certification and accreditation program in which private industry group and trade associations are accredited to conduct approved trade tests, and the local government units to promote such trade testing activities in their respective areas in accordance with the guidelines to be set by the Authority.

The Training Regulations (TR) serve as basis for the:

- 1 Competency assessment and certification;
- 2 Registration and delivery of training programs; and
- 3 Development of curriculum and assessment instruments.

Each TR has four sections:

- Section 1 **Definition of Qualification** – describes the qualification and defines the competencies that comprise the qualification.
- Section 2 The **Competency Standards** format was revised to include the Required Knowledge and Required Skills per element. These fields explicitly state the required knowledge and skills for competent performance of a unit of competency in an informed and effective manner. These also emphasize the application of knowledge and skills to situations where understanding is converted into a workplace outcome.
- Section 3 **Training Arrangements** - contain information and requirements which serve as bases for training providers in designing and delivering competency-based curriculum for the qualification. The revisions to section 3 entail identifying the Learning Activities leading to achievement of the identified Learning Outcome per unit of competency.
- Section 4 **Assessment and Certification Arrangements** - describe the policies governing assessment and certification procedures for the qualification.

TABLE OF CONTENTS

ELECTRICAL & ELECTRONICS SECTOR

SEMICONDUCTOR FRONT-OF-LINE (FOL) OPERATIONS

NATIONAL CERTIFICATE LEVEL II

		Page No.
SECTION 1	SEMICONDUCTOR FOL OPERATIONS NC II QUALIFICATIONS	1
SECTION 2	COMPETENCY STANDARDS	2 - 39
	<ul style="list-style-type: none"> • Basic Competencies • Common Competencies • Core Competencies 	2 - 16 17 - 27 28 - 39
SECTION 3	TRAINING ARRANGEMENTS	40 - 58
	3.1 Curriculum Design 3.2 Training Delivery 3.3 Trainee Entry Requirements 3.4 List of Tools, Equipment and Materials 3.5 Training Facilities 3.6 Trainer's Qualifications 3.7 Institutional Assessment	40 – 55 56 56 57 57 58 58
SECTION 4	ASSESSMENT AND CERTIFICATION ARRANGEMENTS	59 – 60
	DEFINITION OF TERMS	61 – 64
	COMPETENCY MAP	65
	ACKNOWLEDGEMENT	66 – 67

TRAINING REGULATIONS FOR SEMICONDUCTOR FRONT-OF-LINE (FOL) OPERATIONS NC II

Section 1 SEMICONDUCTOR FOL OPERATIONS NC II QUALIFICATIONS

The Semiconductor Front-of-Line (FOL) Operations NC II Qualification consists of competencies that must be possessed to enable a person to work in a semiconductor company engaged in production of semiconductor front-of-line products. This qualification involves such competencies to set up the FOL operations workplace, analyze, carry-out and monitor FOL operations and check quality compliance of FOL operations for semiconductor production line.

This Qualification is packaged from the competency map of the Electrical & Electronics Industry (manufacturing sector) as shown in Annex A.

The units of competency comprising this qualification include the following:

Code	BASIC COMPETENCIES
500311105	Participate in workplace communication
500311106	Work in team environment
500311107	Practice career professionalism
500311108	Practice occupational health and safety procedures
Code	COMMON COMPETENCIES
ELC311205	Use Hand Tools
ELC311204	Apply Quality Standards
ELC311203	Perform Computer Operations
Code	CORE COMPETENCIES
ELC313310	Setup front-of-line (FOL) operations workplace for semiconductor production line
ELC313311	Analyze, carry-out and monitor front-of-line (FOL) operations for semiconductor production line
ELC313312	Check quality compliance of front-of-line (FOL) operations for semiconductor production line

A person who has achieved this Qualification is competent to be:

- Semiconductor Front-of-Line Operator

SECTION 2: COMPETENCY STANDARDS

This section gives the details of the contents of the basic, common, and core units of competency required for Semiconductor Front-of-Line (FOL) Operations NC II.

BASIC COMPETENCIES**UNIT OF COMPETENCY: PARTICIPATE IN WORKPLACE COMMUNICATION**

UNIT CODE : **500311105**

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to gather, interpret and convey information in response to workplace requirements.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Obtain and convey workplace information	1.1. Specific and relevant information is accessed from appropriate sources 1.2. Effective questioning, active listening and speaking skills are used to gather and convey information 1.3. Appropriate medium is used to transfer information and ideas 1.4. Appropriate non- verbal communication is used 1.5. Appropriate lines of communication with supervisors and colleagues are identified and followed 1.6. Defined workplace procedures for the location and storage of information are used 1.7. Personal interaction is carried out clearly and concisely	<ul style="list-style-type: none"> • Effective communication • Different modes of communication • Written communication • Organizational policies • Sources of information • Types of question • Medium of communication • Flow of communication • Storage system • Telephone courtesy 	<ul style="list-style-type: none"> • Follow simple spoken language • Performing routine workplace duties following simple written notices • Ability to relate to people of social range in the workplace • Gather and provide information in response to workplace requirements • Listening skills • Questioning skills • Workplace language skills

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
2. Participate in workplace meetings and discussions	2.1 Team meetings are attended on time 2.2 Own opinions are clearly expressed and those of others are listened to without interruption 2.3 Meeting inputs are consistent with the meeting purpose and established protocols 2.4 Workplace interactions are conducted in a courteous manner 2.5 Questions about simple routine workplace procedures and matters concerning working conditions of employment are asked and responded to according to organizational guidelines 2.6 Meetings outcomes are interpreted and implemented	<ul style="list-style-type: none"> • Communication procedures and systems • Meeting protocols • Nature of workplace meetings • Barriers of communication • Workplace interactions • Nonverbal communication 	<ul style="list-style-type: none"> • Ability to relate to people of social range in the workplace • Interpersonal communication skill • Observing meeting protocols
3. Complete relevant work related documents	3.1 Range of forms relating to conditions of employment are completed accurately and legibly 3.2 Workplace data is recorded on standard workplace forms and documents 3.3 Basic mathematical processes are used for routine calculations 3.4 Errors in recording information on forms/ documents are identified and properly acted upon 3.5 Reporting requirements to supervisor are completed according to organizational guidelines	<ul style="list-style-type: none"> • Technology relevant to the enterprise and the individual's work • Types of workplace documents and forms • Basic mathematical concepts • Kinds of workplace report 	<ul style="list-style-type: none"> • Apply basic mathematical processes of addition, subtraction, division and multiplication • Data recording • Report writing

RANGE OF VARIABLES

VARIABLE	RANGE
1. Appropriate sources	1.1. Team members 1.2. Suppliers 1.3. Trade personnel 1.4. Local government 1.5. Industry bodies
2. Medium	2.1. Memorandum 2.2. Circular 2.3. Notice 2.4. Information discussion 2.5. Follow-up or verbal instructions 2.6. Face to face communication
3. Storage	3.1. Manual filing system 3.2. Computer-based filing system
4. Forms	Personnel forms, telephone message forms, safety reports
5. Workplace interactions	5.1. Face to face 5.2. Telephone 5.3. Electronic and two way radio 5.4. Written including electronic, memos, instruction and forms, non-verbal including gestures, signals, signs and diagrams
6. Protocols	6.1. Observing meeting 6.2. Compliance with meeting decisions 6.3. Obeying meeting instructions

EVIDENCE GUIDE

1. Critical aspects of Competency	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> 1.1. Prepared written communication following standard format of the organization 1.2. Accessed information using communication equipment 1.3. Made use of relevant terms as an aid to transfer information effectively 1.4. Conveyed information effectively adopting the formal or informal communication
2. Resource Implications	<ol style="list-style-type: none"> 2.1. Fax machine 2.2. Telephone 2.3. Writing materials 2.4. Internet
3. Methods of Assessment	<ol style="list-style-type: none"> 3.1. Direct Observation 3.2. Oral interview and written test
4. Context for Assessment	Competency may be assessed individually in the actual workplace or through accredited institution

UNIT OF COMPETENCY: WORK IN TEAM ENVIRONMENT**UNIT CODE : 500311106****UNIT DESCRIPTOR :** This unit covers the skills, knowledge and attitudes to identify role and responsibility as a member of a team.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Describe team role and scope	1.1. The <i>role and objective of the team</i> is identified from available <i>sources of information</i> 1.2. Team parameters, reporting relationships and responsibilities are identified from team discussions and appropriate external sources	<ul style="list-style-type: none"> • Team roles • Definition of Team • Difference between team and group • Different sources of information • Objectives and goals of team 	<ul style="list-style-type: none"> • Describing the team role and scope
1. Identify own role and responsibility within team	2.1 Individual role and responsibilities within the team environment are identified 2.2 Roles and responsibility of other team members are identified and recognized 2.3 Reporting relationships within team and external to team are identified	<ul style="list-style-type: none"> • Team structure • Roles and responsibility of team members • Teams in work environment • Fundamental rights at work including gender sensitivity 	<ul style="list-style-type: none"> • Communicating appropriately, consistent with the culture of the workplace • Identifying individual role and responsibility • Identifying external relationship
2. Work as a team member	3.1 Effective and appropriate forms of communications used and interactions undertaken with team members who contribute to known team activities and objectives 3.2 Effective and appropriate contributions made to complement team activities and objectives, based on individual skills and competencies and workplace context 3.3 Observed protocols in reporting using standard operating procedures 3.4 Contribute to the development of team work plans based on an understanding of team's role and objectives and individual competencies of the members	<ul style="list-style-type: none"> • Communication process • Group planning and decision making • Team goals and objectives • Understanding individual competencies relative to teamwork • Types of individuals • Role of leaders 	<ul style="list-style-type: none"> • Interacting effectively with others • Setting team goals and expectations

RANGE OF VARIABLES

VARIABLE	RANGE
1. Role and objective of team	1.1. Work activities in a team environment with enterprise or specific sector 1.2. Limited discretion, initiative and judgement maybe demonstrated on the job, either individually or in a team environment
2. Sources of information	2.1. Standard operating and/or other workplace procedures 2.2. Job procedures 2.3. Machine/equipment manufacturer's specifications and instructions 2.4. Organizational or external personnel 2.5. Client/supplier instructions 2.6. Quality standards 2.7. OHS and environmental standards
3. Workplace context	3.1. Work procedures and practices 3.2. Conditions of work environments 3.3. Legislation and industrial agreements 3.4. Standard work practice including the storage, safe handling and disposal of chemicals 3.5. Safety, environmental, housekeeping and quality guidelines

EVIDENCE GUIDE

1. Critical aspects of Competency	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> 1.1. Operated in a team to complete workplace activity 1.2. Worked effectively with others 1.3. Conveyed information in written or oral form 1.4. Selected and used appropriate workplace language 1.5. Followed designated work plan for the job 1.6. Reported outcomes
2. Resource Implications	<p>The following resources MUST be provided:</p> <ol style="list-style-type: none"> 2.1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2.2. Materials relevant to the proposed activity or tasks
3. Methods of Assessment	<p>Competency may be assessed through:</p> <ol style="list-style-type: none"> 3.1. Observation of the individual member in relation to the work activities of the group 3.2. Observation of simulation and or role play involving the participation of individual member to the attainment of organizational goal 3.3. Case studies and scenarios as a basis for discussion of issues and strategies in teamwork
4. Context for Assessment	<ol style="list-style-type: none"> 4.1. Competency may be assessed in workplace or in a simulated workplace setting 4.2. Assessment shall be observed while task are being undertaken whether individually or in group

UNIT OF COMPETENCY: PRACTICE CAREER PROFESSIONALISM**UNIT CODE : 500311107****UNIT DESCRIPTOR :** This unit covers the knowledge, skills and attitudes in promoting career growth and advancement.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Integrate personal objectives with organizational goals	1.1. Personal growth and work plans are pursued towards improving the qualifications set for the profession 1.2. Intra- and interpersonal relationships are maintained in the course of managing oneself based on performance evaluation 1.3. Commitment to the organization and its goal is demonstrated in the performance of duties	<ul style="list-style-type: none"> • Work values and ethics (Code of Conduct, Code of Ethics, etc.) • Understanding personal objectives • Understanding organizational goals • Difference between intra and interpersonal relationship • Performance evaluation 	<ul style="list-style-type: none"> • Demonstrate Intra and Interpersonal skills at work • Demonstrate personal commitment in work
2. Set and meet work priorities	2.1 Competing demands are prioritized to achieve personal, team and organizational goals and objectives. 2.2 Resources are utilized efficiently and effectively to manage work priorities and commitments 2.3 Practices along economic use and maintenance of equipment and facilities are followed as per established procedures	<ul style="list-style-type: none"> • Company policies • Company operations, procedures and standards • Time management • Basic strategic planning concepts • Resource utilization and management 	<ul style="list-style-type: none"> • Managing goals and time • Practice economic use of resources and facilities • Setting work priorities • Practice time management
3. Maintain professional growth and development	3.1 Trainings and career opportunities are identified and availed of based on job requirements 3.2 Recognitions are sought/received and demonstrated as proof of career advancement 3.3 Licenses and/or certifications relevant to job and career are obtained and renewed	<ul style="list-style-type: none"> • Career development opportunities • Company recognition and incentives • Information on relevant licenses and or certifications 	<ul style="list-style-type: none"> • Determining personal career development needs • Identifying career opportunities
4. Maintain professional growth and development	4.1 Trainings and career opportunities are identified and availed of based on job requirements	<ul style="list-style-type: none"> • Career development opportunities • Company recognition and incentives 	<ul style="list-style-type: none"> • Determining personal career development needs

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	4.2 <i>Recognitions</i> are sought/received and demonstrated as proof of career advancement 4.3 <i>Licenses and/or certifications</i> relevant to job and career are obtained and renewed	<ul style="list-style-type: none"> • Information on relevant licenses and or certifications 	<ul style="list-style-type: none"> • Identifying career opportunities

RANGE OF VARIABLES

VARIABLE	RANGE
1. Evaluation	1.1 Performance Appraisal 1.2 Psychological Profile 1.3 Aptitude Tests
2. Resources	2.1 Human 2.2 Financial 2.3 Technology 2.3.1 Hardware 2.3.2 Software
3. Trainings and career opportunities	3.1 Participation in training programs 3.1.1 Technical 3.1.2 Supervisory 3.1.3 Managerial 3.1.4 Continuing Education 3.2 Serving as Resource Persons in conferences and workshops
4. Recognitions	4.1 Recommendations 4.2 Citations 4.3 Certificate of Appreciations 4.4 Commendations 4.5 Awards 4.6 Tangible and Intangible Rewards
5. Licenses and/or certifications	5.1 National Certificates 5.2 Certificate of Competency 5.3 Support Level Licenses 5.4 Professional Licenses

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Attained job targets within key result areas (KRAs) 1.2 Maintained intra - and interpersonal relationship in the course of managing oneself based on performance evaluation 1.3 Completed trainings and career opportunities which are based on the requirements of the industries 1.4 Acquired and maintained licenses and/or certifications according to the requirement of the qualification
2. Resource Implications	The following resources MUST be provided: 2.1 Workplace or assessment location 2.2 Case studies/scenarios
3. Methods of Assessment	Competency may be assessed through: 3.1 Portfolio Assessment 3.2 Interview 3.3 Simulation/Role-plays 3.4 Observation 3.5 Third Party Reports 3.6 Exams and Tests
4. Context for Assessment	Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY: PRACTICE OCCUPATIONAL HEALTH AND SAFETY PROCEDURES

UNIT CODE : 500311108

UNIT DESCRIPTOR : This unit covers the outcomes required to comply with regulatory and organizational requirements for occupational health and safety.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify hazards and risks	1.1 Safety regulations and workplace safety and hazard control practices and procedures are clarified and explained based on organization procedures 1.2 Hazards/risks in the workplace and their corresponding indicators are identified to minimize or eliminate risk to co-workers, workplace and environment in accordance with organization procedures 1.3 Contingency measures during workplace accidents, fire and other emergencies are recognized and established in accordance with organization procedures	<ul style="list-style-type: none"> • OHS procedures and practices and regulations • Hazards/risks identification and control • OHS indicators • Organizational contingency practices 	<ul style="list-style-type: none"> • Hazards/risks identification and control skills • Practice of safety and health procedures and personal hygiene
2. Evaluate hazards and risks	2.1 Terms of maximum tolerable limits which when exceeded will result in harm or damage are identified based on threshold limit values (TLV) 2.2 Effects of the hazards are determined 2.3 OHS issues and/or concerns and identified safety hazards are reported to designated personnel in accordance with workplace requirements and relevant workplace OHS legislation	<ul style="list-style-type: none"> • Threshold Limit Value -TLV • Effects of safety hazards 	<ul style="list-style-type: none"> • Communication skills • Reporting safety hazards
3. Control hazards and risks	3.1 Occupational Health and Safety (OHS) procedures for controlling hazards/risks in workplace are consistently followed 3.2 Procedures for dealing with workplace accidents, fire and emergencies are	<ul style="list-style-type: none"> • Personal hygiene practices • Organization safety and health protocol • Company emergency procedure practices 	<ul style="list-style-type: none"> • Practice of personal hygiene • Respond to emergency

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	<p>followed in accordance with organization OHS policies</p> <p>3.3 Personal protective equipment (PPE) is correctly used in accordance with organization OHS procedures and practices</p> <p>3.4 Appropriate assistance is provided in the event of a workplace emergency in accordance with established organization protocol</p>		
4. Maintain OHS awareness	<p>4.1 Emergency-related drills and trainings are participated in as per established organization guidelines and procedures</p> <p>4.2 OHS personal records are completed and updated in accordance with workplace requirements</p>	<ul style="list-style-type: none"> • Workplace OHS personal records • Information on emergency-related drills 	<ul style="list-style-type: none"> • Practice emergency-related drill skills in the workplace

RANGE OF VARIABLES

VARIABLE	RANGE
1. Safety regulations	May include but are not limited to: 1.1 Clean Air Act 1.2 Building code 1.3 National Electrical and Fire Safety Codes 1.4 Waste management statutes and rules 1.5 Philippine Occupational Safety and Health Standards 1.6 DOLE regulations on safety legal requirements 1.7 ECC regulations
2. Hazards/Risks	May include but are not limited to: 2.1 Physical hazards – impact, illumination, pressure, noise, vibration, temperature, radiation 2.2 Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, insects 2.3 Chemical hazards – dusts, fibers, mists, fumes, smoke, gasses, vapors 2.4 Ergonomics 2.4.1 Psychological factors – over exertion/ excessive force, awkward/static positions, fatigue, direct pressure, varying metabolic cycles 2.4.2 Physiological factors – monotony, personal relationship, work out cycle
3. Contingency measures	May include but are not limited to: 3.1 Evacuation 3.2 Isolation 3.3 Decontamination 3.4 (Calling designed) emergency personnel
4. PPE	May include but are not limited to: 4.1 Mask 4.2 Gloves 4.3 Goggles 4.4 Hair Net/cap/bonnet 4.5 Face mask/shield 4.6 Ear muffs 4.7 Apron/Gown/coverall/jump suit 4.8 Anti-static suits
5. Emergency-related drills and training	5.1 Fire drill 5.2 Earthquake drill 5.3 Basic life support/CPR 5.4 First aid 5.5 Spillage control 5.6 Decontamination of chemical and toxic 5.7 Disaster preparedness/management
6. OHS personal records	6.1 Medical/Health records 6.2 Incident reports 6.3 Accident reports 6.4 OHS-related training completed

EVIDENCE GUIDE

1. Critical aspects of Competency	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Explained clearly established workplace safety and hazard control practices and procedures 1.2 Identified hazards/risks in the workplace and its corresponding indicators in accordance with company procedures 1.3 Recognized contingency measures during workplace accidents, fire and other emergencies 1.4 Identified terms of maximum tolerable limits based on threshold limit value- TLV. 1.5 Followed Occupational Health and Safety (OHS) procedures for controlling hazards/risks in workplace 1.6 Used Personal Protective Equipment (PPE) in accordance with company OHS procedures and practices 1.7 Completed and updated OHS personal records in accordance with workplace requirements
2. Resource Implications	<p>The following resources must be provided:</p> <ul style="list-style-type: none"> 2.1 Workplace or assessment location 2.2 OHS personal records 2.3 PPE 2.4 Health records
3. Methods of Assessment	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> 3.1 Portfolio Assessment 3.2 Interview 3.3 Case Study/Situation
4. Context for Assessment	<p>Competency may be assessed in the work place or in a simulated work place setting</p>

COMMON COMPETENCIES

UNIT TITLE : USE HAND TOOLS

UNIT CODE : ELC311205

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes on the safe use, handling and maintenance of tools.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Plan and prepare for tasks to be undertaken	1.1. Tasks to be undertaken are properly identified 1.2. Appropriate hand tools are identified and selected according to the task requirements	<ul style="list-style-type: none"> • Planning and preparing task/activity • Electronics hand tools and their uses • Function, operation and common faults in electronics hand tools 	<ul style="list-style-type: none"> • Preparing required tasks • Communication skills • Using hand tools properly
2. Prepare hand tools	2.1. Appropriate hand tools are checked for proper operation and safety 2.2. Unsafe or faulty tools are identified and marked for repair according to standard company procedure	<ul style="list-style-type: none"> • Checking and safety requirements in handling tools • Standard procedures in checking, identification and marking of safe or unsafe/ faulty tools 	<ul style="list-style-type: none"> • Identifying and checking hand tools • Marking of safe or unsafe/ faulty hand tools
3. Use appropriate hand tools and test equipment	3.1 Tools are used according to tasks undertaken 3.2 All safety procedures in using tools are observed at all times and appropriate personal protective equipment (PPE) are used 3.3 Malfunctions, unplanned or unusual events are reported to the supervisor	<ul style="list-style-type: none"> • Safety requirements in using electronics hand tools and test equipment • Electronics hand tools for adjusting, dismantling, assembling, finishing, and cutting. • Processes, Operations, Systems <ul style="list-style-type: none"> ○ Proper usage and care of hand tools ○ Types and uses of test equipment • Common faults in the use of hand tools 	<ul style="list-style-type: none"> • Reading skills required to interpret work instruction and numerical skills • Using PPE properly • Problem solving in emergency situation

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
4. Maintain hand tools	4.1 Tools are not dropped to avoid damage 4.2 Routine <i>maintenance</i> of tools undertaken according to standard operational procedures, principles and techniques 4.3 Tools are stored safely in appropriate locations in accordance with manufacturer's specifications or standard operating procedures	<ul style="list-style-type: none"> • Safety requirements in maintenance of hand tools • Processes, Operations, Systems <ul style="list-style-type: none"> ○ Maintenance of tools ○ Storage of hand tools 	<ul style="list-style-type: none"> • Checking and cleaning hand tools • Storing hand tools properly

RANGE OF VARIABLES

VARIABLE	RANGE
1. Hand tools	Hand tools for adjusting, dismantling, assembling, finishing, cutting. Tool set includes the following but not limited to: 1.1. screw drivers, 1.2. pliers, 1.3. punches, 1.4. wrenches, 1.5. files
2. Personal Protective Equipment (PPE)	2.1. Gloves 2.2. Protective eyewear 2.3. Apron/overall
3. Maintenance	3.1. Cleaning 3.2. Lubricating 3.3. Tightening 3.4. Simple tool repairs 3.5. Hand sharpening 3.6. Adjustment using correct procedures

EVIDENCE GUIDE

1. Critical aspect of competency	Assessment requires evidence that the candidate: 1.1. Demonstrated safe working practices at all times 1.2. Communicated information about processes, events or tasks being undertaken to ensure a safe and efficient working environment 1.3. Planned tasks in all situations and reviewed task requirements as appropriate 1.4. Performed all tasks to specification 1.5. Maintained and stored tools in appropriate location
2. Method of assessment	Competency in this unit must be assessed through: 2.1. Observation 2.2. Oral questioning
3. Resource Implication	Tools may include the following but not limited to: 3.1 screw drivers 3.2 pliers 3.3 punches 3.4 wrenches, files
4. Context of Assessment	Assessment may be conducted in the workplace or in a simulated work environment

UNIT TITLE : **APPLY QUALITY STANDARDS**

UNIT CODE : **ELC311204**

UNIT DESCRIPTOR : This unit covers the knowledge, skills, (and) attitudes and values needed to apply quality standards in the workplace. The unit also includes the application of relevant safety procedures and regulations, organization procedures and customer requirements

ELEMENT	PERFORMANCE CRITERIA <i>Italicized Bold</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Assess quality of received materials or components	1.1. Work instructions are obtained and work is carried out in accordance with standard operating procedures 1.2. Received materials or component parts are checked against workplace standards and specifications 1.3. Faulty material or components related to work are identified and isolated 1.4. Faults and any identified causes are recorded and/or reported to the supervisor concerned in accordance with workplace procedures 1.5. Faulty materials or components are replaced in accordance with workplace procedures	<ul style="list-style-type: none"> • Relevant production processes, materials and products • Characteristics of materials, software and hardware used in production processes • Quality checking procedures • Quality Workplace procedures • Identification of faulty materials related to work 	<ul style="list-style-type: none"> • Reading skills required to interpret work instruction • Critical thinking • Interpreting work instructions
2. Assess own work	2.1. Documentation relative to quality within the company is identified and used 2.2. Completed work is checked against workplace standards relevant to the task undertaken 2.3. Faulty pieces are identified and isolated 2.4. Information on the quality and other indicators of production performance is recorded in accordance with workplace procedures 2.5. In cases of deviations from specified quality standards , causes are documented and reported in accordance with the workplace' standards operating procedures	<ul style="list-style-type: none"> • Safety and environmental aspects of production processes • Fault identification and reporting • Workplace procedure in documenting completed work • Workplace Quality Indicators 	<ul style="list-style-type: none"> • Carry out work in accordance with OHS policies and procedures

ELEMENT	PERFORMANCE CRITERIA <i>Italicized Bold</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Engage in quality improvement	3.1 Process improvement procedures are participated in relation to workplace assignment 3.2 Work is carried out in accordance with process improvement procedures 3.3 Performance of operation or quality of product or service to ensure customer satisfaction is monitored	<ul style="list-style-type: none"> • Quality improvement processes • Company customers defined 	<ul style="list-style-type: none"> • Solution providing and decision-making • Practice company process improvement procedure

RANGE OF VARIABLES

VARIABLE	RANGE
1. Materials/components	1.1. Materials may include but not limited to: 1.1.1. wires 1.1.2. cables, soldering lead 1.1.3. electrical tape 1.2. Components may include but not limited to: 1.2.1. ICs 1.2.2. Diodes
2. Faults	Faults may include but not limited to: 2.1. Components/materials not according to specification 2.2. Components/materials contain manufacturing defects 2.3. Components/materials do not conform with government regulation i.e., PEC, environmental code 2.4. Components/materials have safety defect
3. Documentation	3.1. Organization work procedures 3.2. Manufacturer's instruction manual 3.3. Customer requirements 3.4. Forms
4. Quality standards	Quality standards may relate but not limited to the following: 4.1 materials 4.2 component parts 4.3 final product 4.4 production processes
5. Customer	5.1 Co-worker 5.2 Supplier 5.3 Client 5.4 Organization receiving the product or service

EVIDENCE GUIDE

1. Critical aspect of competency	<p>Assessment must show that the candidate:</p> <ol style="list-style-type: none"> 1.1. Carried out work in accordance with the company's standard operating procedures 1.2. Performed task according to specifications 1.3. Reported defects detected in accordance with standard operating procedures 1.4. Carried out work in accordance with the process improvement procedures
2. Method of assessment	<p>The assessor may select two (2) of the following assessment methods to objectively assess the candidate:</p> <ol style="list-style-type: none"> 2.1 Observation 2.2 Questioning 2.3 Practical demonstration
3. Resource implication	<p>Materials and component parts and equipment to be used in a real or simulated electronic production situation</p>
4. Context of Assessment	<p>Assessment may be conducted in the workplace or in a simulated environment.</p>

UNIT TITLE : PERFORM COMPUTER OPERATIONS

UNIT CODE : ELC311203

UNIT DESCRIPTOR : This unit covers the knowledge, skills, (and) attitudes and values needed to perform computer operations which include inputting, accessing, producing and transferring data using the appropriate hardware and software

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Plan and prepare for task to be undertaken	1.1. Requirements of task are determined in accordance with the required output. 1.2. Appropriate hardware and software are selected according to task assigned and required outcome. 1.3. Task is planned to ensure that OH & S guidelines and procedures are followed. 1.4. Client -specific guidelines and procedures are followed. 1.5. Required data security guidelines are applied in accordance with existing procedures.	<ul style="list-style-type: none"> • Main types of computers and basic features of different operating systems • Main parts of a computer • Information on hardware and software • Data security guidelines 	<ul style="list-style-type: none"> • Reading and comprehension skills required to interpret work instruction and to interpret basic user manuals. • Communication skills to identify lines of communication, request advice, follow instructions and receive feedback. • Interpreting user manuals and security guidelines
2. Input data into computer	2.1. Data are entered into the computer using appropriate program/application in accordance with company procedures 2.2. Accuracy of information is checked and information is saved in accordance with standard operating procedures 2.3. Inputted data are stored in storage media according to requirements 2.4. Work is performed within ergonomic guidelines	<ul style="list-style-type: none"> • Basic ergonomics of keyboard and computer user • Storage devices and basic categories of memory • Relevant types of software 	<ul style="list-style-type: none"> • Technology skills to use equipment safely including keyboard skills. • Entering data
3. Access information using computer	3.1. Correct program/application is selected based on job requirements 3.2. Program/application containing the information required is accessed according to company procedures	<ul style="list-style-type: none"> • General security, privacy legislation and copyright • Productivity Application • Business Application 	<ul style="list-style-type: none"> • Accessing information • Searching and browsing files and data

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	3.3. Desktop icons are correctly selected, opened and closed for navigation purposes 3.4. Keyboard techniques are carried out in line with OH & S requirements for safe use of keyboards		
4. Produce/output data using computer system	4.1. Entered data are processed using appropriate software commands 4.2. Data printed out as required using computer hardware/peripheral devices in accordance with standard operating procedures 4.3. Files, data are transferred between compatible systems using computer software, hardware/ peripheral devices in accordance with standard operating procedures	<ul style="list-style-type: none"> • Computer application in printing, scanning and sending facsimile • Types and function of computer peripheral devices 	<ul style="list-style-type: none"> • Computer data processing • Printing of data • Transferring files and data
5. Maintain computer equipment and systems	5.1. Systems for cleaning, minor maintenance and replacement of consumables are implemented 5.2. Procedures for ensuring security of data, including regular back-ups and virus checks are implemented in accordance with standard operating procedures 5.3. Basic file maintenance procedures are implemented in line with the standard operating procedures	<ul style="list-style-type: none"> • Computer equipment/system basic maintenance procedures • Viruses • OH & S principles and responsibilities • Calculating computer capacity • System Software • Basic file maintenance procedures 	<ul style="list-style-type: none"> • Removing computer viruses from infected machines • Making backup files

RANGE OF VARIABLES

VARIABLE	RANGE
1. Hardware and peripheral devices	1.1. Personal computers 1.2. Networked systems 1.3. Communication equipment 1.4. Printers 1.5. Scanners 1.6. Keyboard 1.7. Mouse 1.8. Voice/Data logger
2. Software	Software includes the following but not limited to: 2.1. Word processing packages 2.2. Data base packages 2.3. Internet 2.4. Spreadsheets 2.5. Client Specific Software
3. OH & S guidelines	3.1. OHS guidelines 3.2. Enterprise procedures
4. Storage media	Storage media include the following but not limited to: 4.1. USBs 4.2. CDs 4.3. External disk drives 4.4. hard disk drives, local and remote 4.5. optical drives 4.6. cloud storage
5. Ergonomic guidelines	5.1. Types of equipment used 5.2. Appropriate furniture 5.3. Seating posture 5.4. Lifting posture 5.5. Visual display unit screen brightness
6. Desktop icons	Icons include the following but not limited to: 6.1. directories/folders 6.2. files 6.3. network devices 6.4. recycle bin 6.5. program icons
7. Maintenance	7.1. Creating and managing more space in the hard disk and other peripherals 7.2. Reviewing programs 7.3. Deleting unwanted files 7.4. Backing up files 7.5. Checking hard drive for errors 7.6. Using up to date anti-virus programs 7.7. Cleaning dust from internal and external surfaces

EVIDENCE GUIDE

1. Critical aspect of competency	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> 1.1. Selected and used hardware components correctly and according to the task requirement 1.2. Identified and explain the functions of both hardware and software used, their general features and capabilities 1.3. Produced accurate and complete data in accordance with the requirements 1.4. Used appropriate devices and procedures to transfer files/data accurately 1.5. Maintained computer system in line with the standard operating procedures
2. Method of assessment	<p>The assessor may select two of the following assessment methods to objectively assess the candidate:</p> <ol style="list-style-type: none"> 2.1 Observation with oral questioning 2.2 Practical demonstration
3. Resource implication	<ol style="list-style-type: none"> 3.1. Computer hardware with peripherals 3.2. Appropriate software
4. Context of Assessment	<p>Assessment may be conducted in the workplace or in a simulated work environment</p>

CORE COMPETENCIES**UNIT OF COMPETENCY: SET UP FRONT-OF-LINE (FOL) OPERATIONS WORKPLACE FOR SEMICONDUCTOR PRODUCTION LINE****UNIT CODE : ELC313310****UNIT DESCRIPTOR :** This unit covers the knowledge, skills and attitudes needed in setting up the front-of-line (FOL) operation workplace for semiconductor production line. This includes gathering production tools and materials, setting up semiconductor FOL machine parameters and peripherals, accomplishing production line checklist and performing daily maintenance activity.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Gather tools and materials for semiconductor FOL process	1.1. Process requirements are determined according to production specifications 1.2. Appropriate hand tools, PPE and materials are selected and completed according to process requirements and required time 1.3. Quantity and quality of materials are checked in accordance to production specifications 1.4. Completeness and accuracy of documents are checked in accordance to production specifications	<ul style="list-style-type: none"> • Awareness of semiconductor production line systems and processes • Familiarity with semiconductor production line FOL materials • Understanding bill of materials, travelers, check list and other applicable semiconductor production line FOL documents/ specifications. • Awareness of safe handling of tools and materials i.e. 5S, Material Safety Data Sheet (MSDS), Personal Protective Equipment (PPE), Electro Static Discharge (ESD), Environmental Health Systems (EHS), Occupational Health and Safety (OHS). • Understanding of IPC standards • Awareness of international quality standards <ul style="list-style-type: none"> ○ Quality Management System ○ Environmental Management System • Awareness of visual criteria • Familiarity with semiconductor production line FOL tools • Time consciousness on set up time 	<ul style="list-style-type: none"> • Reading skills • Basic mathematical skills • Communication skills • Computer skills • Detecting abnormality or non-conformance • Writing skills

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1 Set-up semiconductor FOL machine parameters and peripherals	2.1 Walk-around check or visual inspection of FOL machine is done prior to production operations 2.2 Semiconductor FOL machine parameters are set correctly according to production specifications 2.3 Semiconductor FOL machine parameters and peripherals are checked according to production specifications 2.4 Any non-conformance to specifications are reported to appropriate personnel	<ul style="list-style-type: none"> • Semiconductor production line FOL machine set up parameters • Awareness of safety operation of FOL machines • Reading of different gauges • Awareness of set up criteria • Awareness of applicable Out of Control Action Plan (OCAP) 	<ul style="list-style-type: none"> • Skills in basic machine operation and set-up • Detecting abnormality or non-conformance • Communication skills <ul style="list-style-type: none"> ○ Written ○ Oral
2 Accomplish semiconductor production line checklist	3.1 All check items are performed according to specifications 3.2 Semiconductor production line checklist are correctly filled-out according to specifications 3.3 Semiconductor production line checklist is completed based on required time 3.4 Work turnover procedure is performed for next work shift	<ul style="list-style-type: none"> • Completeness and accuracy of information on production line checklist • Work values and ethics <ul style="list-style-type: none"> ○ Attentiveness ○ Time consciousness ○ Cost-consciousness ○ Quality-consciousness 	<ul style="list-style-type: none"> • Filling up appropriate information on checklist/ lot travelers
3 Perform daily preventive maintenance (PM)	4.1 Semiconductor machine basic physical condition are checked according to specifications 4.2 If necessary, daily PM is performed based on required time 4.3 Any non-conformance to specifications are reported to appropriate personnel 4.4 Housekeeping procedures are observed in accordance with 5S discipline and established procedures	<ul style="list-style-type: none"> • Workplace organization (layout/arrangement of workplace) • Understanding the applicable PM checklist • Time consciousness • Awareness on applicable out of control action plan (OCAP) • 5S principles 	<ul style="list-style-type: none"> • Checking of machine basic physical condition • Detecting abnormality or non-conformance • Writing skills • Skills in housekeeping

RANGE OF VARIABLES

VARIABLE	RANGE
1. Materials	Semiconductor materials may include: <ul style="list-style-type: none"> 1.1 wafer 1.2 Cassette 1.3 Laminating Tape 1.4 Epoxy 1.5 Lead frame 1.6 Wire (wire bond) 1.7 Capillary 1.8 Die bonded units 1.9 Wire bonded units 1.10 Molded Units 1.11 Molding compounds 1.12 Trays/ tube 1.13 Applicable Chemicals
2. Production specifications	<ul style="list-style-type: none"> 2.1 Machine specifications 2.2 Set-up checklist 2.3 Work Instructions (WI) 2.4 Production procedures 2.5 Out of Control Plan (OCAP) procedures 2.6 Control Plan procedures 2.7 Statistical Process Control (SPC) procedures 2.8 Work Manual 2.9 Production Process and Flow Diagrams 2.10 Job Hazards Analysis (JHA)
3. Hand tools	<ul style="list-style-type: none"> 3.1 Tweezers 3.2 Vacuum Pen 3.3 Allen Keys 3.4 Calculator 3.5 Torque driver
4. PPE	<ul style="list-style-type: none"> 4.1 ESD apparel <ul style="list-style-type: none"> 4.1.1 Shoes 4.1.2 Smock and Head cap 4.1.3 Jacket 4.1.4 Bunny suit 4.1.5 Face mask 4.1.6 Wrist ground strap 4.1.7 Gloves 4.2 Safety shoes 4.3 Gloves 4.4 Safety goggles 4.5 Ear plugs 4.6 Gas Mask

VARIABLE	RANGE
5. Processes	Semiconductor front-of-line processes may include but not be limited to: 5.1 Wafer back grinding 5.2 Wafer testing 5.3 Die Cutting 5.4 Die Attached 5.5 Wire bonding 5.6 Molding
6. Required time	6.1 Set up/ Change over time 6.2 Production cycle time 6.3 Process cycle time 6.4 Machine Uptime
7. Documents	7.1 Production form 7.1.1 Lot summary 7.1.2 PM checklist 7.1.3 Monitoring checklist 7.1.4 SPC checklist 7.1.5 Production log sheet 7.2 Material / Lot traveler 7.3 Work Instruction (WI) 7.4 Set up sheet 7.5 Outbound check list
8. Machine parameters	8.1 Machine type 8.2 Machine model 8.3 Machine settings 8.4 Material/ Product type 8.5 Material/ Product model
9. Appropriate personnel	9.1 Immediate supervisor 9.2 Maintenance personnel 9.3 Engineer 9.4 Quality Control personnel
10. Machine basic physical conditions	May include: 10.1 Complete screws (for accessible parts only) 10.2 Fan is working 10.3 No oil leakage 10.4 No broken wire 10.5 Free from foreign materials 10.6 Industrial PC in good condition 10.7 Dust free

EVIDENCE GUIDE

1. Critical aspects of Competency	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Gathered production tools and materials semiconductor front-of-line operation according to approved production specifications 1.2 Checked and set up semiconductor front-of-line machine parameters and peripherals for production startup and usage 1.3 Accomplished semiconductor front-of-line production quality checklist according to quality manuals and procedures 1.4 Checked machine basic physical condition in accordance to production line standards and performed daily maintenance activity based on required time
2. Resource Implications	<p>The following resources MUST be provided:</p> <ul style="list-style-type: none"> 2.1 Appropriate semiconductor FOL machine and equipment 2.2 Tools (as indicated in the Range Of Variables) 2.3 Materials 2.4 Work Instructions Assessment rating sheet 2.5 Sample production checklist 2.6 Applicable forms for specific equipment or machines 2.7 Procedure and quality manuals 2.8 Personal Computer 2.1 Printer 2.9 Reporting forms
3. Methods of Assessment	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> 3.1 Demonstration with oral questioning 3.2 Direct Observation with oral questioning 3.3 Exams and Tests
4. Context for Assessment	<p>Competency may be assessed in the work place or in a simulated work place setting</p>

UNIT OF COMPETENCY: ANALYZE, CARRY-OUT AND MONITOR FRONT-OF-LINE (FOL) OPERATIONS FOR SEMICONDUCTOR PRODUCTION LINE

UNIT CODE : ELC313311

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes needed in performing any process, either automated or manual, in front-of-line (FOL) operation for semiconductor production line. This includes initializing/operating semiconductor FOL equipment, running sample units and loading production units. It also includes performing FOL manual processes, if applicable.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Initialize/ Operate semiconductor FOL machine/ equipment	1.1 Safety requirements are complied with using the operation manual 1.2 Appropriate PPE and ESD apparels are used in the performance of the job 1.3 Appropriate tools and materials are used according to process requirements 1.4 Semiconductors FOL machine settings are checked according to product specifications 1.5 Semiconductor FOL machine is initialized/operated in accordance to assigned line by supervisor 1.6 Semiconductor FOL machine's troubles/problems are immediately recorded and reported to the appropriate personnel	<ul style="list-style-type: none"> • Awareness on safe working conditions • Awareness on semiconductors machine safety features and guidelines • Semiconductors production systems <ul style="list-style-type: none"> ○ Batch ○ Continuous • Awareness on the following; 5S, Material Safety Data Sheet (MSDS), Personal Protective Equipment (PPE), Electro Static Discharge (ESD), Environmental Health Systems (EHS), Occupational Health and Safety (OHS) • Understanding semiconductors production line FOL product and process specification • Operation of semiconductors production line FOL machines • Basic semiconductors FOL machines/ equipment troubles/ breakdowns • Interpreting of different gauges readings • Visual/mechanical criteria 	<ul style="list-style-type: none"> • Reading skills • Basic mathematical skills • Communication skills • Computer skills • Observation Skills • Writing skills • Machine Operation skills

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
2. Run semiconductors FOL sample units	2.1 Semiconductors FOL sample output is checked in accordance to product criteria 2.2 Semiconductors FOL sample unit is loaded to the equipment in accordance to product orientation and specifications 2.3 If applicable, manual semiconductor FOL process is performed in accordance with work instructions and company procedures 2.4 Out of control action plan (OCAP) is followed in case of any non-conformance or deviation to the process 2.5 Semiconductors FOL production forms are accomplished based on production procedures	<ul style="list-style-type: none"> • Product visual/ mechanical criteria • Types of semiconductors production line FOL sample units • Product orientation • Understanding of OCAP on running semiconductors production line FOL sample units • Completeness and accuracy of information on production line FOL form for sample units 	<ul style="list-style-type: none"> • Reading skills • Observation Skills • Observation Skills • FOL machine operation skills • Detecting abnormality or non-conformance • Writing skills
3. Load semiconductors FOL production units	3.1 Production output is checked in accordance to product criteria 3.2 Production units are loaded to the equipment in accordance to product orientation and specifications 3.3 If applicable, manual semiconductor FOL process is performed in accordance with work instructions and company procedures 3.4 Out of control action plan (OCAP) is followed in case of any non-conformance or deviation to the process 3.5 Semiconductors FOL production forms are accomplished based on production procedures	<ul style="list-style-type: none"> • Semiconductors production line FOL operation process controls • Understanding of OCAP on semiconductors production line FOL operation • Completeness and accuracy of information on production line FOL form for production units • Work values and ethics <ul style="list-style-type: none"> ○ Attentiveness ○ Time consciousness ○ Cost-consciousness ○ Quality-consciousness 	<ul style="list-style-type: none"> • Reading skills • Communication skills • Computer skills • Observation Skills • FOL machine operation skills • Detecting abnormality or non-conformance • Writing skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. PPE	Personal protective equipment may include: 1.1 Safety shoes 1.2 Gloves 1.3 Safety goggles
2. ESD apparels	ESD apparels may include: 2.1 Shoes 2.2 Smock and Head cap 2.3 Jacket 2.4 Bunny suit 2.5 Face mask 2.6 Wrist/Foot ground strap
3. Tools and materials	Appropriate tools and materials may include: 3.1 Tools 3.1.1 Tweezers 3.1.2 Vacuum Pen 3.1.3 Allen Keys 3.1.4 Calculator 3.1.5 Torque driver 3.2 Materials 3.2.1 Appropriate production components 3.2.2 ESD apparels
4 Semiconductor FOL machines	Semiconductor FOL Machines may include: 4.1 Wafer Saw Machine 4.2 Die Bond Machine 4.3 Wire Bond Machine 4.4 Molding Machines 4.5 DTFS machines
5 Semiconductor FOL processes	Semiconductor FOL processes may include: 5.1 Wafer back grinding 5.2 Wafer testing 5.3 Die Cutting 5.4 Die Attached 5.5 Wire bonding 5.6 Molding
6 Product criteria	Product criteria may include: 6.1 Electrical criteria 6.2 Visual criteria 6.3 Mechanical criteria

VARIABLE	RANGE
7 Sample Unit	Sample units may include: 7.1 Good Unit 7.2 Reject Unit 7.3 Dummy Unit 7.4 Standard Unit
8. Production forms	Production forms may include: 8.1 Lot traceability 8.2 SPC checklist 8.3 Monitoring checklist 8.4 PM checklist 8.5 Production log sheet

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Operated semiconductor front-of-line machine/ equipment according to production requirements 1.2 Run semiconductor front-of-line sample units in accordance to product orientation and specifications 1.3 Loaded semiconductor front-of-line production units in accordance to product orientation and specifications
2. Resource Implications	The following resources MUST be provided: 2.1 Appropriate semiconductor FOL machine and equipment 2.2 Tools (as indicated in the Range Of Variables) 2.3 Appropriate production units and materials 2.4 Work Instructions Assessment rating sheet 2.5 Sample production checklist 2.6 Applicable forms for specific equipment or machines 2.7 Procedure and quality manuals 2.8 Personal Computer 2.9 Printer 2.10 Reporting forms
3. Methods of Assessment	Competency may be assessed through: 3.1 Demonstration with oral questioning 3.2 Direct Observation with oral questioning 3.3 Examination
4. Context for Assessment	Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY: CHECK QUALITY COMPLIANCE OF FRONT-OF-LINE (FOL) OPERATIONS FOR SEMICONDUCTOR PRODUCTION LINE

UNIT CODE : ELC313312

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes needed in performing front-of-line (FOL) operation for semiconductor production line. This includes monitoring front-end machine/equipment operation, completing lot traceability and performing visual machine inspection.

ELEMENT	PERFORMANCE CRITERIA <i>Italicized</i> terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Monitor semiconductor FOL operation	1.1. Output and yield are checked in accordance with production requirements 1.2. Out of control action plan (OCAP) is followed in case of any non-conformance or deviation to the process 1.3. Semiconductor FOL production forms are accomplished in accordance with process requirements	<ul style="list-style-type: none"> • Yield requirement • Machine capacity • Understanding of OCAP on FOL machine/equipment operation • Basic Statistical Process Control (SPC) • Completeness and accuracy of information on semiconductor production line FOL form for unusual machine operation 	<ul style="list-style-type: none"> • Reading skills • Communication skills • Monitoring skills • Detecting abnormality or non-conformance • Writing skills
2. Perform visual inspection	2.1 Finished products are checked/ inspected using appropriate instruments/tools 2.2 Physical defects are identified based on product specifications 2.3 Conforming and non-conforming products are identified and segregated in accordance with production procedures 2.4 Housekeeping procedures are observed in accordance with 5S discipline and established procedures	<ul style="list-style-type: none"> • Finished products judgment criteria on semiconductor production line FOL processes • Uses of appropriate instruments/tools • Procedures on identification and segregation of non-conforming products in semiconductor production line FOL operation • 5S principles 	<ul style="list-style-type: none"> • Reading skills • Communication skills • Computer skills • Observation Skills • Detecting abnormality or non-conformance • Writing skills • Skills in housekeeping and 5S
3. Complete semiconductor FOL lot traceability	3.1 Lot traceability are transacted in accordance with production procedures 3.2 Conforming and non-conforming products are identified and segregated in accordance with production procedures 3.3 Disposition of lots is determined in accordance with product criteria	<ul style="list-style-type: none"> • Lot traceability • Types of semiconductor production line FOL product defects • Process controls on lots traceability 	<ul style="list-style-type: none"> • Communication skills • Computer skills • Observation Skills • Detecting abnormality or non-conformance • Writing skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Production forms	Production forms may include: 1.1 Lot summary 1.2 SPC checklist 1.3 Monitoring checklist 1.4 PM checklist 1.5 Production log sheet
2. Transacted lot traceability	Transaction may include: 2.1 Manual 2.2 Automated
3. Disposition of lots	Disposition of lots may include: 3.1 Pass 3.2 Failed 3.3 Hold 3.4 Scrap 3.5 Re-screen/ Re-work/Re-test
4. Appropriate instruments/tools	Appropriate instruments/tools may include: 4.1 Stereoscopic microscope 4.2 magnifying lens
5. Physical defects	Physical defects may include: 5.1 Wafer defects 5.2 Broken wire 5.3 Die crack 5.4 Wafer scratch 5.5 Presence of foreign materials 5.6 lead defects 5.7 mold defects

EVIDENCE GUIDE

1. Critical aspects of Competency	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Monitored semiconductor front-of-line operation based on product requirements 1.2 Completed semiconductor front-of-line lot traceability in accordance with production procedures 1.3 Performed visual inspection in accordance to semiconductor production line standards
2. Resource Implications	<p>The following resources MUST be provided:</p> <ul style="list-style-type: none"> 2.1 Appropriate Semiconductor FOL machine and equipment 2.2 Tools (as indicated in the Range Of Variables) 2.3 Appropriate production units and materials 2.4 Work Instructions Assessment rating sheet 2.5 Sample production checklist 2.6 Applicable forms for specific equipment or machines 2.7 Procedure and quality manuals 2.8 Personal Computer 2.9 Printer 2.10 Reporting forms
3. Methods of Assessment	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> 3.1 Demonstration with oral questioning 3.2 Direct Observation with oral questioning 3.3 Examination
4. Context for Assessment	<p>Competency may be assessed in the work place or in a simulated work place setting</p>

SECTION 3 TRAINING ARRANGEMENTS

These guidelines are set to provide the Technical and Vocational Education and Training (TVET) providers with information and other important requirements to consider when designing training programs for Semiconductor Front-of-Line (FOL) Operations NC II.

They include information on curriculum design; training delivery; trainee entry requirements; tools and equipment; training facilities; and trainer's qualification.

3.1 CURRICULUM DESIGN

TESDA shall provide the training on the development of competency-based curricula to enable training providers develop their own curricula with the components mentioned below.

Delivery of knowledge requirements for the basic, common and core units of competency specifically in the areas of mathematics, science/technology, communication/language and other academic subjects shall be contextualized. To this end, TVET providers shall develop a Contextual Learning Matrix (CLM) to accompany their curricula.

Course Title: Semiconductor Front-of-Line Operations

NC Level: NC II

Nominal Training Duration: 16 hrs – Basic Competencies
16 hrs – Common Competencies
48 hrs – Core Competencies

80 hrs - Total

Course Description:

This course is designed to develop & enhance the knowledge, skills, & attitudes of a Semiconductor FOL Operator, in accordance with industry standards. It covers the basic & common competencies in addition to the core competencies such as preparing workplace, analyzing, carrying-out and monitoring front-of-line machine/equipment operations and checking quality compliance for semiconductor production line.

To obtain this, all units prescribed for this qualification must be achieved.

BASIC COMPETENCIES

(16 hours)

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
1. Participate in workplace communication	1.1 Obtain and convey workplace information	<ul style="list-style-type: none"> • Describe Organizational policies 	<ul style="list-style-type: none"> • Group discussion 	<ul style="list-style-type: none"> • Oral evaluation 	4 Hours
		<ul style="list-style-type: none"> • Read: <ul style="list-style-type: none"> ○ Effective communication ○ Written communication ○ Communication procedures and systems 			
		<ul style="list-style-type: none"> • Identify: <ul style="list-style-type: none"> ○ Different modes of communication ○ Medium of communication ○ Flow of communication ○ Available technology relevant to the enterprise and the individual's work responsibilities 	<ul style="list-style-type: none"> • Lecture 	<ul style="list-style-type: none"> • Written examination 	
		<ul style="list-style-type: none"> • Prepare different Types of question 			
		<ul style="list-style-type: none"> • Gather different sources of information 	<ul style="list-style-type: none"> • Demonstration 	<ul style="list-style-type: none"> • Observation 	
		<ul style="list-style-type: none"> • Apply storage system in establishing workplace information 			
		<ul style="list-style-type: none"> • Demonstrate Telephone courtesy 			
	1.2 Complete relevant work related documents	<ul style="list-style-type: none"> • Describe Communication procedures and systems 	<ul style="list-style-type: none"> • Group discussion 	<ul style="list-style-type: none"> • Oral evaluation 	
		<ul style="list-style-type: none"> • Read: <ul style="list-style-type: none"> ○ Meeting protocols ○ Nature of workplace meetings 	<ul style="list-style-type: none"> • Lecture 	<ul style="list-style-type: none"> • Written examination 	
			<ul style="list-style-type: none"> • Lecture 	<ul style="list-style-type: none"> • Written 	

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
		<ul style="list-style-type: none"> ○ Workplace interactions ○ Barriers of communication 		examination	
		<ul style="list-style-type: none"> ● Complete work related documents 	<ul style="list-style-type: none"> ● Demonstration 	<ul style="list-style-type: none"> ● Observation 	
		<ul style="list-style-type: none"> ● Read instructions on work related forms/documents 	<ul style="list-style-type: none"> ● Lecture 	<ul style="list-style-type: none"> ● Written examination 	
		<ul style="list-style-type: none"> ● Practice: <ul style="list-style-type: none"> ○ Estimate, calculate and record routine workplace measures ○ Basic mathematical processes of addition, subtraction, division and multiplication 	<ul style="list-style-type: none"> ● Demonstration 	<ul style="list-style-type: none"> ● Observation 	
		<ul style="list-style-type: none"> ● Demonstrate office activities in: <ul style="list-style-type: none"> ○ workplace meetings and discussions scenario 	<ul style="list-style-type: none"> ● Role play 	<ul style="list-style-type: none"> ● Oral evaluation ● Observation 	
		<ul style="list-style-type: none"> ● Perform workplace duties scenario following simple written notices 	<ul style="list-style-type: none"> ● Role play 	<ul style="list-style-type: none"> ● Oral evaluation ● Observation 	
		<ul style="list-style-type: none"> ● Follow simple spoken language 	<ul style="list-style-type: none"> ● Demonstration 	<ul style="list-style-type: none"> ● Observation 	
		<ul style="list-style-type: none"> ● Identify the different Non-verbal communication 	<ul style="list-style-type: none"> ● Lecture 	<ul style="list-style-type: none"> ● Written examination 	
		<ul style="list-style-type: none"> ● Demonstrate ability to relate to people of social range in the workplace 	<ul style="list-style-type: none"> ● Demonstration 	<ul style="list-style-type: none"> ● Observation 	
		<ul style="list-style-type: none"> ● Gather and provide information in response to workplace requirements 	<ul style="list-style-type: none"> ● Demonstration 	<ul style="list-style-type: none"> ● Observation 	
	1.3 Participate in workplace meeting and discussion	<ul style="list-style-type: none"> ● Identify: <ul style="list-style-type: none"> ○ types of workplace documents and forms ○ kinds of workplace report 	<ul style="list-style-type: none"> ● Lecture 	<ul style="list-style-type: none"> ● Written examination 	

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
		<ul style="list-style-type: none"> ○ Available technology relevant to the enterprise and the individual's work responsibilities 			
		<ul style="list-style-type: none"> ● Read and follow instructions in applying basic mathematical concepts 			
		<ul style="list-style-type: none"> ● Follow simple spoken language 	<ul style="list-style-type: none"> ● Demonstration 	<ul style="list-style-type: none"> ● Observation 	
		<ul style="list-style-type: none"> ● Demonstrate ability to relate to people of social range in the workplace 	<ul style="list-style-type: none"> ● Demonstration 	<ul style="list-style-type: none"> ● Observation 	
		<ul style="list-style-type: none"> ● Gather and provide information in response to workplace requirements 			
2. Work in a team environment	2.1 Describe and identify team role and responsibility in a team.	<ul style="list-style-type: none"> ● Describe the team role and scope 	<ul style="list-style-type: none"> ● Group discussion 	<ul style="list-style-type: none"> ● Oral evaluation 	4 Hours
		<ul style="list-style-type: none"> ● Read <ul style="list-style-type: none"> ○ Definition of Team ○ Difference between team and group ○ Objectives and goals of team 	<ul style="list-style-type: none"> ● Lecture 	<ul style="list-style-type: none"> ● Written examination 	
		<ul style="list-style-type: none"> ● Identify different sources of information 	<ul style="list-style-type: none"> ● Lecture 	<ul style="list-style-type: none"> ● Written examination 	
		<ul style="list-style-type: none"> ● Describe team goals and objectives 	<ul style="list-style-type: none"> ● Group discussion 	<ul style="list-style-type: none"> ● Oral evaluation 	
	2.2 Describe work as a team	<ul style="list-style-type: none"> ● Perform exercises in setting team goals and expectations scenario 	<ul style="list-style-type: none"> ● Role play 	<ul style="list-style-type: none"> ● Oral evaluation ● Observation 	
		<ul style="list-style-type: none"> ● Identify: <ul style="list-style-type: none"> ○ individual role and responsibility 	<ul style="list-style-type: none"> ● Lecture 	<ul style="list-style-type: none"> ● Written examination 	
		<ul style="list-style-type: none"> ● Practice Interacting effectively with others 	<ul style="list-style-type: none"> ● Group discussion 	<ul style="list-style-type: none"> ● Oral evaluation 	

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
		<ul style="list-style-type: none"> • Read: <ul style="list-style-type: none"> ○ Fundamental rights at work including gender sensitivity ○ Understanding individual competencies relative to teamwork ○ Types of individuals ○ Role of leaders 	<ul style="list-style-type: none"> • Lecture 	<ul style="list-style-type: none"> • Written examination 	
3. Practice career professionalism	3.1 Integrate personal objectives with organizational goals	<ul style="list-style-type: none"> • Describe performance evaluation 	<ul style="list-style-type: none"> • Group discussion 	<ul style="list-style-type: none"> • Oral evaluation 	4 Hours
		<ul style="list-style-type: none"> • Read: <ul style="list-style-type: none"> ○ Work values and ethics (Code of Conduct, Code of Ethics, etc.) ○ Understanding personal objectives ○ Understanding organizational goals 	<ul style="list-style-type: none"> • Lecture 	<ul style="list-style-type: none"> • Written examination 	
		<ul style="list-style-type: none"> • Demonstrate Intra and Interpersonal skills at work 	<ul style="list-style-type: none"> • Demonstration 	<ul style="list-style-type: none"> • Observation 	
		<ul style="list-style-type: none"> • Demonstrate personal commitment in work 			
	3.2 Set and meet work priorities	<ul style="list-style-type: none"> • Describe company policies, operations, procedures and standards 	<ul style="list-style-type: none"> • Group discussion 	<ul style="list-style-type: none"> • Oral evaluation 	
		<ul style="list-style-type: none"> • Read: <ul style="list-style-type: none"> ○ Time Management ○ Basic strategic planning concepts ○ Resource utilization and management 	<ul style="list-style-type: none"> • Lecture 	<ul style="list-style-type: none"> • Written examination 	
		<ul style="list-style-type: none"> • Apply managing goals and time 			<ul style="list-style-type: none"> • Demonstration

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
		<ul style="list-style-type: none"> • Practice: <ul style="list-style-type: none"> ○ economic use of resources and facilities ○ time management 	• Demonstration	• Observation	
	3.3 Maintain professional growth and development	• Describe company recognition and incentives	• Group discussion	• Oral evaluation	
		• Read: <ul style="list-style-type: none"> ○ Career development opportunities ○ Information on relevant licenses and or certifications ○ personal career development needs 	• Lecture	• Written examination	
		• Identify career opportunities	• Lecture	• Written examination	
		• Determine personal career development needs	• Group discussion	• Oral evaluation	
4. Practice occupational health and safety	4.1 Identify hazard and risks	• Describe OHS procedures, practices and regulations	• Group discussion	• Oral evaluation	4 Hours
		• Read <ul style="list-style-type: none"> ○ OHS indicators ○ Organizational contingency practices 	• Lecture	• Written examination	
		• Practice hazards/risks identification and control			
		4.2 Evaluate hazard and risks	• Describe effects of safety hazards	• Group discussion	
	• Read <ul style="list-style-type: none"> ○ Threshold Limit Value –TLV 	• Lecture	• Written examination		
	• Practice reporting safety hazards	• Role play	• Observation		

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
		<ul style="list-style-type: none"> • Demonstrate evaluating hazards and risks using communication equipment 	<ul style="list-style-type: none"> • Demonstration 	<ul style="list-style-type: none"> • Observation 	
	4.3 Control hazards and risks	<ul style="list-style-type: none"> • Describe : <ul style="list-style-type: none"> ○ Organization safety and health protocol ○ Company emergency procedure practices 	<ul style="list-style-type: none"> • Group discussion 	<ul style="list-style-type: none"> • Oral evaluation 	
		<ul style="list-style-type: none"> • Practice personal hygiene 	<ul style="list-style-type: none"> • Demonstration 	<ul style="list-style-type: none"> • Observation 	
		<ul style="list-style-type: none"> • Practice drills on responding to emergency 	<ul style="list-style-type: none"> • Demonstration • Simulation 	<ul style="list-style-type: none"> • Observation 	
		<ul style="list-style-type: none"> • Identify emergency-related drills information 	<ul style="list-style-type: none"> • Lecture 	<ul style="list-style-type: none"> • Written examination 	
	4.4 Maintain occupational health and safety awareness	<ul style="list-style-type: none"> • Practice occupational safety and health standards on personal records in the workplace 	<ul style="list-style-type: none"> • Role play 	<ul style="list-style-type: none"> • Observation 	
		<ul style="list-style-type: none"> • Practice emergency related drills in the workplace 	<ul style="list-style-type: none"> • Demonstration • Simulation 	<ul style="list-style-type: none"> • Observation 	

COMMON COMPETENCIES

(16 hours)

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
1. Use Hand Tools	1.1 Plan and prepare for tasks to be undertaken	<ul style="list-style-type: none"> ▪ Plan and prepare for task/activity ▪ Identify different types and functions of hand tools ▪ Identify electronics hand tools and their uses ▪ Identify function, operation and common faults in electronics hand tools 	<ul style="list-style-type: none"> ▪ Lecture / Demonstration ▪ Distance education ▪ Film Showing 	<ul style="list-style-type: none"> ▪ Written/Oral examination ▪ Practical demonstration 	½ hour
	1.2 Prepare hand tools	<ul style="list-style-type: none"> ▪ Practice proper use of hand tools ▪ Practice checking and safety requirements in handling tools ▪ Apply standard procedures in checking, identification and marking of safe or unsafe/ faulty tools ▪ Perform marking of safe or unsafe/ faulty hand tools 	<ul style="list-style-type: none"> ▪ Lecture / Demonstration ▪ Distance education ▪ Film Showing 	<ul style="list-style-type: none"> ▪ Written/Oral examination ▪ Practical demonstration 	½ hour
	1.3 Use appropriate hand tools and test equipment.	<ul style="list-style-type: none"> ▪ Apply safety handling of hand tools and test equipment ▪ Identify/Select electronics hand tools for adjusting, dismantling, assembling, finishing, and cutting ▪ Use appropriate hand tools and test equipment for the job requirement ▪ Read and learn the - <ul style="list-style-type: none"> • Proper usage and care of hand tools • Types and uses of test equipment ▪ Identify common faults in the use of hand tools 	<ul style="list-style-type: none"> ▪ Lecture / Demonstration ▪ Distance education ▪ Film Showing 	<ul style="list-style-type: none"> ▪ Written/Oral examination ▪ Practical demonstration 	½ hours
	1.4 Maintain hand tools	<ul style="list-style-type: none"> ▪ Apply safety requirements in maintenance of hand tools ▪ Read and understand processes, operations & systems for: <ul style="list-style-type: none"> • Maintenance of tools • Storage of hand tools ▪ Apply 5S principles in maintenance of hand tools 	<ul style="list-style-type: none"> ▪ Lecture / Demonstration ▪ Distance education ▪ Film Showing 	<ul style="list-style-type: none"> ▪ Written/Oral examination ▪ Practical demonstration 	½ hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
2. Apply Quality Standards	4.1 Assess quality of received materials	<ul style="list-style-type: none"> ▪ Identify relevant production processes, materials and products ▪ Study and interpret characteristics of materials, software and hardware used in production processes ▪ Perform quality checking procedures ▪ Apply quality Workplace procedures ▪ Identify faulty materials ▪ Check quality of materials or component parts as per manufacturer's standards ▪ Interpret specifications or symbols 	<ul style="list-style-type: none"> ▪ Field trip ▪ Symposium ▪ Video clips ▪ Simulation/ Role playing 	<ul style="list-style-type: none"> ▪ Written test ▪ Demonstration & questioning ▪ Observation & questioning 	4 hours
	4.2 Assess own work	<ul style="list-style-type: none"> ▪ Perform workplace procedure in documenting completed work ▪ Perform fault identification and reporting ▪ Observe safety and environmental aspects of production processes ▪ Utilize workplace quality indicators ▪ Document and report deviations from specified quality standards 	<ul style="list-style-type: none"> ▪ Field trip ▪ Symposium ▪ Film showing ▪ Simulation 	<ul style="list-style-type: none"> ▪ Demonstration & questioning ▪ Observation & questioning ▪ Third party report 	4 hours
	4.3 Engage in quality improvement	<ul style="list-style-type: none"> ▪ Participate in quality improvement processes <ul style="list-style-type: none"> a. IEC/ISO standards b. Environmental and safety standards ▪ Carry out work as per process improvement procedures ▪ Monitor operation performance ▪ Implement continuous improvement 	<ul style="list-style-type: none"> ▪ Field trip ▪ Symposium ▪ Film showing ▪ Simulation 	<ul style="list-style-type: none"> ▪ Demonstration & questioning ▪ Observation & questioning ▪ Third party report 	4 hours
3. Perform Computer Operation	5.1 Plan and prepare for task to be undertaken	<ul style="list-style-type: none"> ▪ Plan and prepare computer operation activity ▪ Determine task requirements based on required output ▪ Determine appropriate hardware and software ▪ Identify/Select types of computers and basic features of different operating systems ▪ Interpret and follow client -specific guidelines and procedures 	<ul style="list-style-type: none"> ▪ Modular ▪ Film showing ▪ Computer based training (e-learning) ▪ Project method 	<ul style="list-style-type: none"> ▪ Demonstration & questioning ▪ Observation & questioning ▪ Third party report ▪ Computer- based assessment 	½ hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		<ul style="list-style-type: none"> ▪ Plan task as per data security guidelines 			
	5.2 Input data into computer	<ul style="list-style-type: none"> ▪ Apply basic ergonomics of keyboard and computer user ▪ Enter/Encode data using appropriate computer programs/applications ▪ Check accuracy of encoded data/information per SOP ▪ Save and store inputted data in storage media ▪ Storage devices and basic categories of memory Identify and define relevant types of software 	<ul style="list-style-type: none"> ▪ Modular ▪ Film showing ▪ Computer based training (e-learning) ▪ Project method 	<ul style="list-style-type: none"> ▪ Demonstration & questioning ▪ Observation & questioning ▪ Assessment of output product ▪ Computer- based assessment 	1 hour
	5.3 Access information using computer	<ul style="list-style-type: none"> ▪ Select correct program/ application based on job requirements ▪ Access computer data/files ▪ Interpret general security, privacy legislation and copyright ▪ Use Productivity Application <ul style="list-style-type: none"> ▪ Microsoft office applications ▪ Learn Business Application <ul style="list-style-type: none"> ▪ Introduction to Basic Programming software ▪ Apply basic ergonomics of keyboard and computer user 	<ul style="list-style-type: none"> ▪ Modular ▪ Film showing ▪ Computer based training (e-learning) ▪ Project method 	<ul style="list-style-type: none"> ▪ Demonstration & questioning ▪ Observation & questioning ▪ Third party report ▪ Assessment of output product ▪ Computer- based assessment 	½ hour
	5.4 Produce/ output data using computer system	<ul style="list-style-type: none"> ▪ Identify types and function of computer peripheral devices ▪ Print and scan office documents and materials ▪ Send office/ business documents through facsimile ▪ Transfer files or data between compatible systems using computer software, hardware/ peripheral devices ▪ Save documents in storage devices <ol style="list-style-type: none"> a. CD/DVD b. USB drives c. Hard disk drives 	<ul style="list-style-type: none"> ▪ Modular ▪ Film showing ▪ Computer based training (e-learning) ▪ Project method 	<ul style="list-style-type: none"> ▪ Demonstration & questioning ▪ Observation & questioning ▪ Third party report ▪ Assessment of output product ▪ Portfolio ▪ Computer- based assessment 	½ hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
	5.5 Maintain computer equipment and systems	<ul style="list-style-type: none"> ▪ Perform computer equipment/ system basic maintenance procedures <ul style="list-style-type: none"> a. Perform basic file maintenance procedures b. Perform cleaning of PC parts/ hardware components c. Scan/Debug computer software and applications d. Perform cleaning and defragmentation of computer files e. Perform backup of computer files ▪ Enumerate and define different types of computer viruses 	<ul style="list-style-type: none"> ▪ Modular ▪ Film showing ▪ Computer based training (e-learning) ▪ Project method 	<ul style="list-style-type: none"> ▪ Demonstration & questioning ▪ Third party report ▪ Assessment of output product ▪ Portfolio 	½ hour

CORE COMPETENCIES

(48 hours)

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
1. Setup front-of-line (FOL) operations workplace for semiconductor production line	1.1 Gather production tools and materials for semiconductor FOL operation	<ul style="list-style-type: none"> • Identify/determine semiconductor FOL manufacturing processes • Understand purpose and background of setup FOL operation workplace for semiconductor production line • Identify and gather required materials, tools and equipment • Apply proper handling and accounting of materials, tools and equipment • Identify and check required documents • Read and understand: <ul style="list-style-type: none"> • 5S principles • Occupational Health and Safety (OHS) • Material Safety Data Sheet (MSDS) • Personal Protective Equipment (PPE) • Electro Static Discharge (ESD) • Environmental Health Systems (EHS) • IPC standards • Quality Management System (QMS) • Environmental Management System 	<ul style="list-style-type: none"> • Lecture • Discussion • Demonstration • Viewing multimedia 	<ul style="list-style-type: none"> • Observation in workplace • Written exam • Practical exam 	2hrs
	1.2 Set up semiconductor FOL machine parameters and peripherals.	<ul style="list-style-type: none"> • Conduct walk-around check or visual inspection of semiconductor FOL machine • Set/Check required semiconductor FOL machine parameters • Discuss and demonstrate procedures in set up of semiconductor FOL machine parameters and peripherals 	<ul style="list-style-type: none"> • Lecture • Discussion • Demonstration • Viewing multimedia 	<ul style="list-style-type: none"> • Observation in workplace • Written exam • Practical exam 	2 hrs
					8 hrs

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		<ul style="list-style-type: none"> • Study types and functions of semiconductor FOL machine and peripherals • Learn and apply safety measures in machine operations • Learn and determine applicable out-of-control action plan(OCAP) • Use appropriate tools • Use appropriate equipment • Perform inspection, cleaning, storage, operator preventive maintenance 			
	1.3 Accomplish semiconductor FOL checklist	<ul style="list-style-type: none"> • Study the types of production line documents/ checklists • Identify and accomplish required documents/ checklists • implement work turnover procedure 	<ul style="list-style-type: none"> • Lecture • Discussion • Demonstration • Viewing multimedia 	<ul style="list-style-type: none"> • Observation in workplace • Written exam • Practical exam 	2 hrs
	1.4 Perform daily maintenance activity	<ul style="list-style-type: none"> • Identify and check semiconductor FOL machine basic physical condition • Perform daily PM activity based on checklist • Identify applicable out-of-control action plan(OCAP) • Apply 5S principles/ housekeeping procedures 	<ul style="list-style-type: none"> • Lecture • Discussion • Demonstration • Viewing multimedia 	<ul style="list-style-type: none"> • Observation in workplace • Written exam • Practical exam 	2 hrs
2. Analyze, carry-out and monitor FOL operations for semiconductor production line					24 hrs
	2.1 Initialize/ Operate semiconductor FOL machine/ equipment	<ul style="list-style-type: none"> • Learn and apply safety requirements in the operation manual • Learn and interpret overview of semiconductor FOL processes • Identify types of semiconductor FOL sample units • Learn and determine product orientation • Perform procedure in processing electronics FOL sample units • Perform manual semiconductor FOL processes 	<ul style="list-style-type: none"> • Lecture • Discussion • Hands-on • Demonstration • Viewing multimedia 	<ul style="list-style-type: none"> • Written exam • Practical exam • Observation in workplace 	16 hrs

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		<ul style="list-style-type: none"> • Identify semiconductor FOL equipment troubles/problems • Determine machines alarms/errors • Identify appropriate PPE and ESD apparels • Study and determine applicable out-of-control action plan(OCAP) • Observe and determine visual/mechanical criteria • Use appropriate tools • Accomplish production line documents 			
	2.2 Run semiconductors FOL sample units	<ul style="list-style-type: none"> • Identify usage and types of semiconductor FOL sample units according to product criteria • Study and learn product orientation • Learn usage of appropriate PPE and ESD apparels • Use appropriate tools • Perform/Practice procedure in loading and processing semiconductor FOL sample units • Practice manual semiconductor FOL process based on instruction and company procedures • Learn and identify machines alarms/errors • Determine applicable out-of-control action plan(OCAP) for semiconductor FOL • Perform visual/ mechanical inspection • Accomplish production line documents 	<ul style="list-style-type: none"> • Lecture • Discussion • Hands-on • Viewing multimedia 	<ul style="list-style-type: none"> • Written exam • Practical exam 	4 hrs
	2.3 Load semiconductors FOL production units	<ul style="list-style-type: none"> • Identify/Determine semiconductor FOL operations process controls • Study and learn product orientation and specifications • Identify usage of appropriate PPE and ESD apparels • Use appropriate tools • Perform procedures in loading and processing production units based on product orientation and specifications • Check production output based on product criteria 	<ul style="list-style-type: none"> • Lecture • Discussion • Hands-on • Viewing multimedia 	<ul style="list-style-type: none"> • Written exam • Practical exam 	4 hrs

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		<ul style="list-style-type: none"> Practice manual semiconductor FOL process based on instruction and company procedures Determine machines alarms/errors Determine applicable out-of-control action plan(OCAP) on semiconductor FOL operations Verify product criteria Perform visual/ mechanical inspection Accomplish semiconductor FOL production line documents 			
3. Check quality compliance of FOL operations for semiconductor production line					16 hrs
	3.1 Monitor semiconductor FOL operation	<ul style="list-style-type: none"> Check output and yield requirements Determine machine capacity Learn and apply Basic Statistical Process Control (SPC) rules / applicable out-of-control action plan(OCAP) Verify product criteria Perform visual/ mechanical inspection Determine abnormality or non-conformance or deviation to the process Accomplish required production forms Check completeness and accuracy of information on semiconductor FOL production form for unusual machine operation 	<ul style="list-style-type: none"> Lecture Discussion Hands-on Demonstration Viewing multimedia 	<ul style="list-style-type: none"> Written exam Practical exam Observation in workplace 	4 hrs
	3.2 Perform visual inspection	<ul style="list-style-type: none"> Use appropriate inspection tools Identify types of semiconductor FOL product defects Apply finished products judgment criteria on semiconductor FOL processes Check/Inspect products using appropriate instruments/tools Perform procedures on identification and segregation of non-conforming products in semiconductor FOL 	<ul style="list-style-type: none"> Lecture Discussion Hands-on Demonstration Viewing multimedia 	<ul style="list-style-type: none"> Written exam Practical exam Observation in workplace 	10 hrs

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Approach	Nominal Duration
		operation <ul style="list-style-type: none"> • Apply 5S principles/ housekeeping procedures • Perform visual inspection 			
	3.3 Complete semiconductor FOL lot traceability	<ul style="list-style-type: none"> • Perform lot traceability transaction <ul style="list-style-type: none"> ○ Lot accounting steps • Accomplish production forms and documents • Identify and segregate conforming and non-conforming products • Learn and apply process controls on lots transaction 	<ul style="list-style-type: none"> • Lecture • Discussion • Hands-on • Demonstration • Viewing multimedia 	<ul style="list-style-type: none"> • Written exam • Practical exam • Observation in workplace 	2 hrs

3.2 TRAINING DELIVERY

1. The delivery of training shall adhere to the design of the curriculum. Delivery shall be guided by the principles of competency-based TVET.
 - a. Course design is based on competency standards set by the industry or recognized industry sector; (**Learning system is driven by competencies written to industry standards**)
 - b. Training delivery is learner-centered and should accommodate individualized and self-paced learning strategies;
 - c. Training can be done on an actual workplace setting, simulation of a workplace and/or through adoption of modern technology.
 - d. Assessment is based in the collection of evidence of the performance of work to the industry required standards;
 - e. Assessment of competency takes the trainee's knowledge and attitude into account but requires evidence of actual performance of the competency as the primary source of evidence.
 - f. Training program allows for recognition of prior learning (RPL) or current competencies;
 - g. Training completion is based on satisfactory performance of all specified competencies.
2. The competency-based TVET system recognizes various types of delivery modes, both on-and off-the-job as long as the learning is driven by the competency standards specified by the industry. The following training modality and its variations/components may be adopted singly or in combination with other modalities when designing and delivering training programs:

2.1. Enterprise-Based:

- **Enterprise-based Training-** where training is implemented within the company in accordance with the requirements of the specific company. Specific guidelines on this mode shall be issued by the TESDA Secretariat.

3.3 TRAINEE ENTRY REQUIREMENTS

The trainees who wish to enter the course should possess the following requirements:

- Must have completed at least 10 yrs. basic education or an alternative learning systems (ALS) certificate of achievement with grade 10 equivalent holder
- Can communicate orally & in writing
- Can perform basic mathematical computations

3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS

Recommended list of tools, equipment and materials for the training of 25 trainees for Semiconductor Front-of-Line Operations NC II

TOOLS		EQUIPMENT		MATERIAL				
Qty.	Description	Qty.	Description	Qty.	Description			
25 pcs	<ul style="list-style-type: none"> • Tweezers, Stainless • Vacuum Pen • Allen Keys • Calculator • Torque driver, 3-RTD 	*As required	<u>Semiconductor front-of-line machines:</u> <ul style="list-style-type: none"> • Wafer Saw Machine • Die Bond Machine • Wire Bond Machine • Molding Machines 	25 sets	Appropriate materials for training purposes: ESD Apparel <ul style="list-style-type: none"> • Shoes • Smock and Head cap • ESD Jacket • Bunny suit • Face mask • Wrist/Foot ground strap 			
5 pcs						5 sets	Work tables with chairs	
5 sets						2 pcs.	White board	25 pairs
25 pcs						1 unit	LCD projector	25 pairs
5 pcs						1 unit	Desktop PC/Laptop	25 pcs
					Safety shoes Gloves Safety goggles			

3.5 TRAINING FACILITIES

Based on class size of 25 students/trainees the space requirements for the teaching/learning and circulation areas are as follows:

TEACHING/LEARNING AREAS	SIZE IN METERS	AREA IN SQ. METERS	QTY	TOTAL AREA IN SQ. METERS
Lecture Area	5 x 8	40	1	40
Laboratory Area	5 x 8	40	1	40
Learning Resource Area	4 x 5	20	1	20
Tool Room / Storage Area	4 x 5	20	1	20
Wash ,Toilet & Locker Room	1 x 2	2	1	2
Total				122
Facilities / Equipment / Circulation**				36
Total Area				158

** Area requirement is equivalent to 30% of the total teaching/learning areas

3.6 TRAINERS QUALIFICATIONS

- Must be a holder of **Semiconductor FOL Operations NC II**
- Must have a TESDA Trainer's Methodology Course certificate or must have passed the Train the Trainers certification process
- Must be at least two-year college level or two-year vocational course graduate.
- Must have at least 2-years relevant industry experience in the current field.

* **Optional:** only when required by hiring institution.

3.7 INSTITUTIONAL ASSESSMENT

Institutional assessment is undertaken by trainees to determine their achievement of the requirements of the units of competency. A certificate of achievement is issued for each unit of competency.

The result of the institutional assessment may be considered as evidence for the assessment for national certification. As a matter of policy, graduates of programs registered with TESDA under this training regulation are required to undergo mandatory national competency assessment upon completion of the program.

SECTION 4: ASSESSMENT AND CERTIFICATION ARRANGEMENT

Competency Assessment is the process of collecting evidence and making judgments whether competency has been achieved. The purpose of assessment is to confirm that an individual can perform to the standards expected at the workplace as expressed in relevant competency standards.

The assessment process is based on evidence or information gathered to prove achievement of competencies. The process may be applied to an employable unit(s) of competency in partial fulfillment of the requirements of the national qualification.

4.1. NATIONAL ASSESSMENT AND CERTIFICATION ARRANGEMENTS

- 4.1.1. To attain the National Qualification of **Semiconductor Front-of-Line (FOL) Operations NC II**, the candidate must demonstrate in all the units listed in Section 1. Successful candidates shall be awarded a **National Certificate II** signed by the TESDA Director General.
- 4.1.2. The qualification of **Semiconductor Front-of-Line (FOL) Operations NC II** can be attained through demonstration of competence through project-type assessment covering all the units required in the qualification.
- 4.1.3. Assessment shall focus on the core units of competency. The basic and common units shall be integrated or assessed concurrently with the core units.
- 4.1.4. The following are qualified to apply for assessment and certification:
 - a. Graduate of formal, non-formal, and informal including enterprise-based education/training programs/courses.
 - b. Experienced workers (wage employed or self-employed)
- 4.1.5. The guidelines on assessment and certification are discussed in detail in the “Procedures Manual on Assessment and Certification” and “Guidelines on the Implementation of the Philippine TVET Competency Assessment and Certification System (PTCACS)”.

4.2. COMPETENCY ASSESSMENT REQUISITE

- 4.2.1 Self-Assessment Guide. The self-assessment guide (SAG) is accomplished by the candidate prior to actual competency assessment. SAG is a pre-assessment tool to help the candidate and the assessor determine what evidence is available, where gaps exist, including readiness for assessment.

This document can:

- a. Identify the candidate’s skills and knowledge
- b. Highlight gaps in candidate’s skills and knowledge
- c. Provide critical guidance to the assessor and candidate on the evidence that need to be presented

- d. Assist the candidate to identify key areas in which practice is needed or additional information or skills that should be gained prior assessment
- 4.2.2 Accredited Assessment Center. Only Assessment Center accredited by TESDA is authorized to conduct competency assessment. Assessment centers undergo a quality assured procedure for accreditation before they are authorized by TESDA to manage the assessment for National Certification.
- 4.2.3 Accredited Competency Assessor. Only accredited competency assessor is authorized to conduct assessment of competence. Competency assessors undergo a quality assured system of accreditation procedure before they are authorized by TESDA to assess the competencies of candidates for National Certification.

DEFINITION OF TERMS

GENERAL

- 1) **Certification** - is the process of verifying and validating the competencies of a person through assessment
- 2) **Certificate of Competency (COC)** – is a certification issued to individuals who pass the assessment for a single unit or cluster of units of competency
- 3) **Common Competencies** - are the skills and knowledge needed by all people working in a particular industry
- 4) **Competency** - is the possession and application of knowledge, skills and attitudes to perform work activities to the standard expected in the workplace
- 5) **Competency Assessment** - is the process of collecting evidence and making judgments on whether competency has been achieved
- 6) **Competency Standard (CS)** - is the industry-determined specification of competencies required for effective work performance
- 7) **Context of Assessment** - refers to the place where assessment is to be conducted or carried out
- 8) **Core Competencies** - are the specific skills and knowledge needed in a particular area of work - industry sector/occupation/job role
- 9) **Critical aspects of competency** - refers to the evidence that is essential for successful performance of the unit of competency
- 10) **Elective Competencies** - are the additional skills and knowledge required by the individual or enterprise for work
- 11) **Elements** - are the building blocks of a unit of competency. They describe in outcome terms the functions that a person performs in the workplace.
- 12) **Evidence Guide** - is a component of the unit of competency that defines or identifies the evidences required to determine the competence of the individual. It provides information on critical aspects of competency, underpinning knowledge, underpinning skills, resource implications, assessment method and context of assessment
- 13) **Level** - refers to the category of skills and knowledge required to do a job
- 14) **Method of Assessment** - refers to the ways of collecting evidence and when, evidence should be collected
- 15) **National Certificate (NC)** – is a certification issued to individuals who achieve all the required units of competency for a national qualification defined under the Training Regulations. NCs are aligned to specific levels within the PTQF

- 16) **Performance Criteria** - are evaluative statements that specify what is to be assessed and the required level of performance
- 17) **Qualification** - is a cluster of units of competencies that meets job roles and is significant in the workplace. It is also a certification awarded to a person on successful completion of a course in recognition of having demonstrated competencies in an industry sector
- 18) **Range of Variables** - describes the circumstances or context in which the work is to be performed
- 19) **Recognition of Prior Learning (RPL)** – is the acknowledgement of an individual's skills, knowledge and attitudes gained from life and work experiences outside registered training programs
- 19) **Resource Implication** - refer to the resources needed for the successful performance of the work activity described in the unit of competency. It includes work environment and conditions, materials, tools and equipment
- 20) **Basic Competencies** - are the skills and knowledge that everyone needs for work
- 21) **Training Regulations (TR)** – refers to the document promulgated and issued by TESDA consisting of competency standards, national qualifications and training guidelines for specific sectors/occupations. The TR serves as basis for establishment of qualification and certification under the PTQF. It also serves as guide for development of competency-based curricula and instructional materials including registration of TVET programs offered by TVET providers
- 22) **Underpinning Knowledge** - refers to the competency that involves in applying knowledge to perform work activities. It includes specific knowledge that is essential to the performance of the competency
- 23) **Underpinning Skills** - refers to the list of the skills needed to achieve the elements and performance criteria in the unit of competency. It includes generic and industry specific skills
- 24) **Unit of Competency** – is a component of the competency standards stating a specific key function or role in a particular job or occupation; it is the smallest component of achievement that can be assessed and certified under the PTQF

SECTOR SPECIFIC

- 1) **Cleanroom** or **clean room** is an environment, typically used in manufacturing or scientific research, with a low level of environmental pollutants such as dust, airborne microbes, aerosol particles, and chemical vapors. More accurately, a cleanroom has a controlled level of contamination that is specified by the number of particles per cubic meter at a specified particle size.
- 2) **Electronic manufacturing services (EMS)** is a term used for companies that design, test, manufacture, distribute, and provide return/repair services for electronic components and assemblies for original equipment manufacturers (OEMs). The concept is also referred to as electronic contract manufacturing (ECM).
- 3) **Electrostatic discharge (ESD)** is a swift discharge of electric current between two objects with different charges and different numbers of electrons. This exchange of electrons creates a large electromagnetic field buildup, resulting in ESD. Certain electronic devices are vulnerable to low-voltage ESD. For example, a hard drive is susceptible to just 10 volts. Integrated circuits (IC) are also prone to ESD and may be permanently damaged by high-voltage currents.
- 4) **Front-end-of-line (FEOL)** is the first portion of IC fabrication where the individual devices (transistors, capacitors, resistors, etc.) are patterned in the semiconductor. FEOL generally covers everything up to (but not including) the depositions of metal interconnect layers.
- 5) **Hard disk drive (HDD)** is a data storage device used for storing and retrieving digital information using rapidly rotating disks (platters) coated with magnetic material. An HDD retains its data even when powered off. Data is read in a random-access manner, meaning individual blocks of data can be stored or retrieved in any order rather than sequentially. An HDD consists of one or more rigid ("hard") rapidly rotating disks (platters) with magnetic heads arranged on a moving actuator arm to read and write data to the surfaces.
- 6) A **head-gimbal assembly** of a hard disk drive includes a load beam connected to a pivot arm, a slider on which a magnetic head is mounted, an elastic support member having one end coupled to the load beam and the other free end portion at which the slider is supported, and a damper provided between the load beam and the slider to attenuate vibration transferred between the load beam and the slider.
- 7) **IPC, the Association Connecting Electronics Industries**, is a trade association whose aim is to standardize the assembly and production requirements of electronic equipment and assemblies. IPC is accredited by the American National Standards Institute (ANSI) as a standards developing organization and is known globally for its standards. It publishes the most widely used acceptability standards in the electronics industry.
- 8) In manufacturing, **lot traceability** is readily-available access to the complete history of all manufactured **lots**, batches and serialized units, spanning production in multiple plants.

- 9) **MSDS** (an acronym for Material Safety Data Sheet) - is an important component of product stewardship and occupational safety and health. It is intended to provide workers and emergency personnel with procedures for handling or working with that substance in a safe manner, and includes information such as physical data (melting point, point, flash, etc.), toxicity, health effects, first aid, reactivity, storage, disposal, protective equipment, and spill-handling procedures. It is a written document that outlines information and procedures for handling and working with chemicals. Current MSDS documents contain physical and chemical property information, potential hazard information, emergency procedures, and manufacturer contact information. MSDS formats can vary from source to source within a country depending on national requirements.
- 10) **Out-of-control action plan (OCAP)** - is a flowchart that guides employees' reactions to out-of-control situations. It consists of activators (which define out-of-control conditions); checkpoints (which are likely causes for the conditions); and terminators (which contain the action that should resolve the conditions). OCAPs are dynamic. For example, Pareto analyses of OCAPs can identify commonly used terminators and suggests methods to eliminate frequent causes of problems or to modify the OCAPs that react to common out-of-control situations. Benefits of OCAPs include the empowerment given to the operators to troubleshoot problems. Other benefits are increased process efficiency and standardization of problem solving techniques.
- 11) **Personal Protective Equipment (PPE)** - specialized clothing or equipment worn by employees for protection against health and safety hazards. Personal protective equipment is designed to protect many parts of the body, i.e., eyes, head, face, hands, feet, and ears.
- 12) **Production line** - is a set of sequential operations established in a manufacturing establishment whereby materials are put through a process to produce an end-product. The machines and peripheral equipment are in the order they are used. The process is not stopped and restarted for each new product as the line is dedicated to producing a single or small group of products.
- 13) **Quality management system (QMS)** - is a collection of business processes focused on achieving your quality policy and quality objectives — i.e. what your customer wants and needs. It is expressed as the organizational structure, policies, procedures, processes and resources needed to implement quality management.
- 14) **Statistical process control (SPC)** - is a method of quality control which uses statistical methods. SPC is applied in order to monitor and control a process. Monitoring and controlling the process ensures that it operates at its full potential.

ANNEX A - COMPETENCY MAP

Semiconductor Front-of-Line Operation NC II

BASIC COMPETENCIES

Receive and Respond to Workplace Communication	Work with Others	Demonstrate work values	Practice basic housekeeping procedures	Participate in Workplace Communication
Work in a Team Environment	Practice career professionalism	Practice occupational health and safety procedures	Lead Workplace Communication	Lead Small Team
Develop and practice negotiation skills	Solve Problems Related to Work Activities	Use mathematical concepts and techniques	Use relevant technologies	Utilize Specialist Communication Skills
Develop Team and Individuals	Apply Problem Solving Techniques in the Workplace	Collect, analyze and organize information	Plan and Organize Work	Promote environmental protection

COMMON COMPETENCIES

Use Hand Tools	Perform Mensuration and Calculation	Prepare and Interpret Technical Drawing	Apply Quality Standards	Perform Computer Operations
Terminate and Connect Electrical Wiring and Electronic Circuits	Test Electronic Components			

CORE COMPETENCIES

Install Instrumentation and Control Devices	Calibrate Instrumentation and Control Devices	Configure Instrumentation and Control Devices	Loop Check Instrumentation and Control Devices	Maintain and Repair Instrumentation & Control Devices
Start-up Instrumentation and Control Systems	Diagnose and Troubleshoot Instrumentation and Control Systems	Install Mechatronics Devices	Configure & Test Mechatronics Devices	Maintain and Repair Mechatronics Devices
Develop Mechatronics Control Circuits & Software Application Programs	Commission Mechatronics Systems	Diagnose and Troubleshoot Mechatronics Systems	Service and Repair Audio Systems and Products	Service and Repair Video Systems and Products
Service and Repair Business Machines	Assemble and Disassemble Consumer Electronic Products	Maintain and Repair Electronically Controlled Domestic Appliances	Maintain and Repair Audio-Video Products and Systems	Maintain and Repair Cellular Phones
Commission Consumer Electronic Products and Systems	Develop Servicing Systems for Consumer Electronic Products	Train service technician	Manage Servicing Systems for Consumer Electronics Products and Systems	Train service technician supervisors
Set up Back-end Operations Workplace for Electronics Production Line	Perform Back-end Operations for Electronics Production Line	Set up Back-end Operations Workplace for Semiconductor Production Line	Perform Back-end Operations for Semiconductor Production Line	Check quality compliance of back-end operations for Semiconductor production line
Check quality compliance of back-end operations for electronics production line	Set up Front-of-Line (FOL) Operations Workplace for Electronics Production Line	Set up Front-of-Line (FOL) Operations Workplace for Semiconductor Production Line	Analyze, carry-out and monitor Front-of-Line (FOL) Operations for Semiconductor Production Line	Check quality compliance of Front-of-Line (FOL) operations for Semiconductor production line
Perform Front-of-Line (FOL) Operations for Electronics Production Line	Check quality compliance of Front-of-Line (FOL) operations for electronics production line	Set up Back-end Operations Workplace for HDD Production Line	Perform Back-end Operations for Hard Disk Drives (HDD) Production Line	Check quality compliance of back-end operations for HDD production line
		Set up Front-of-Line (FOL) Operations Workplace for HDD Production Line	Perform Front-of-Line (FOL) Operations for HDD Production Line	Check quality compliance of Front-of-Line (FOL) operations for HDD production line

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