



# INDUSTRIAL ELECTRICIAN CURRICULUM (LEVEL -3/ G - I)

British Council “Skills for Employability Project”

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## Definition of Terms

### Assessment Criteria

The specification of the expected performance demonstrated by the student or earner at the conclusion of the learning experiences in a particular module or course. It is used to assess the necessary knowledge, skills and attitudes, reflecting the performance standard in the relevant industry or competency standards.

### Assessment method

Assessment methods may include observation, simulation, questioning, presentation/ demonstration and written assessment. The various methods or techniques used to gather evidence of sufficiency and quality in which to make a sound judgment on the competency student or learner

### Basic Competency

Basic competency is a cluster of related skills, knowledge and attitudes that is simple and fundamental in most jobs, occupation or responsibility in the same level of qualifications and that is expected of the individual in the world of work. For instance, all skilled workers are expected to “perform mensuration and calculation” or to “observe safety rules and practices”; or similarly, a technician is expected to “lead a team” or “prepare the scope of work” responsibilities

### Certification of Competency

This is the culmination of the CBT process in which the student or trainee is awarded a certificate on the level of competency that is usually based on a National Qualification Standard. For instance, after completion of a CBT course and the corresponding assessment conducted by a duly accredited assessor or assessment agency, a National or Federal Certificate of the student’s or candidate’s competency ( e.g.: Electrician – Federal Certificate II) is awarded if has the competency of a skilled Electrician.

### Common Competency

Common competency is a cluster of related skills, knowledge and attitudes that is similarly done across a cluster of jobs in a particular trade or occupation in the same level of qualifications that is expected of the individual in the world of work. While a basic competency is similarly required in most jobs, a common competency is usually restricted in one cluster of occupations. For instance, common competencies in measurements in the area of construction are essentially different from that of mechanical trades, or electronics.



## Competency

Competency is a cluster of related skills, knowledge and attitudes that forms part of one's job or occupation that correlates with and measured by the performance standards set by industry, and that can be developed and improved through training and development. Competency is based on performance of tasks identified by experts in the given occupation.

## Competency-Based Curriculum (CBC)

A competency-based curriculum is a framework or guide in the form of a **course design** for a particular field or occupation and a series of **modules** of instruction that are based on competency standards, with corresponding learning outcomes, assessment criteria, contents, conditions and methodologies of instruction, and assessment method. The competency-based curriculum specifies outcomes, which are consistent with the requirements of the workplace as agreed through the industry or community consultations. *Where competency standard do not exist, curriculum developers need to clearly identify workplace standards and requirements as a basis to identify the outcomes of the competency-based curriculum.*

## Competency-Based Training (CBT)

A training system that organizes instruction based on competency standards and evaluates how well the student performs after instruction according to a set of performance standard. It refers to a systematic approach to organizing instruction that focuses on defining in measurable terms what students are to learn and then evaluating how well they can perform designated tasks after instruction.

## Competency-based Technical Education and Vocational Training (CBTVET)

CBTVET or the application of CBT in TVET is a systematic approach in organizing and providing instruction in measurable terms what the student has to learn in a particular technical or professional skill, trade or occupation, and then evaluating how well the student perform/demonstrate the knowledge or skills that were taught. Performance in terms of technical knowledge and skills by various means is made to determine the mastery or level of competency.

## Competency Standard

The description of what individuals do in the workplace at various levels and the standard set by the workplace or the industry; defines or specifies how well the worker or trainee should perform a job or function. Likewise, it identifies the characteristics possessed by people that enable them to be either assessed or judged competent in a particular job or occupation.



## Course design

This is a major element of the CBC that defines the title of the course and its description, qualification level and units of competency, course outcomes, course structure and competency analysis, assessment and instructional delivery, and the list of resources and qualifications of instructors.

## Course Title

This refers to the title or name of the course design of a particular technology, industry, or occupation, reflecting employment needs as outlined in the competency standard.

## Core Competency

Core competencies are the main group of skills, knowledge and attitudes that are unique for a particular trade, occupation or technology. These are competencies that are used only on a particular trade, occupation or technology; or allied trades using similar material, such as wood technology or metal technology.

## Curriculum

In general, curriculum is a set of courses organized and offered by an educational institution with the purpose of attaining a set of learning objectives or goals or learning a set of knowledge, skills, and attitudes within a specified period. For instance, a TVET curriculum is a course or set of courses on a particular technical field, trade or occupation (e.g. automotive technology; civil or construction technology; electrical technology, or mechanical technology) for the purpose of preparing an individual for employment or promotion on the job.

## Curriculum Development Team

This is a group of people representing industry, curriculum developers and teachers or trainers experienced in the field/industry organized to develop a curriculum. The team may work as a group or assign each member a part to accomplish at their own phase and time until the curriculum is completed.

## DACUM

It simply means developing a curriculum. A method of occupational (or task) analysis, where occupational experts in a particular trade or technology come to a workshop led by a trained facilitator, to provide input on the specific tasks, knowledge and skills required to perform them.

## Entry Requirements

This is a list of requirements that the student must possess to be allowed to participate or attend the teaching-learning session of a particular module of



instruction. It is distinct from the institutional requirements that are required of the student upon admission to the school.

## Industry

In this Manual, the term industry is used generally to include all the sectors of the economy or the community such as manufacturing firms, service shops, business establishments, government agencies, and NGOs that employ the mid-level technical manpower that are trained by TVET institutions as well as colleges and universities and other training institutions.

## Learning Conditions

The requirements under which the teaching-learning process and assessment will be performed. These may include a list of tools, equipment and materials, training facilities, learning resources such as books, manuals, multi-media and other resources. It also specifies the scope or range of the equipment and facilities to be assessed.

## Learning Outcomes

These are competencies (technical knowledge, skills and attitudes) learned or acquired by the student or trainee on a particular module, course, or curriculum. They are expected competencies developed under a particular unit or module of instruction.

## Module Contents

These are specific knowledge, skills and attitudes or learning experiences that are covered to be addressed expected learning outcomes.

## Module Description

This is a statement that describes what the module is all about, its scope and delimitation.

## Module Duration

This refers to the estimated or suggested length of time (in hours) spent teaching learning a particular module.

## Module (of Training)

Also known as *module of instruction*, it refers to the other element of the CBC that defines how the competency or elements of the competency is organized for instructional purposes based on a set of competency standards.



## Module Title

This refers to the competency or elements of the competency that is developed into a module or unit of instruction or training.

## National Qualification Framework

A structure of well defined and nationally accredited or recognized qualifications which are awarded in predetermined levels. It also refers to the structure or path through which formal, non-formal and informal education and training are all recognized and credited towards a particular qualification.

## Qualification

A set or package of standards considered to be worthy of recognition in a certificate issued by a duly recognized institution. It also refers to the possession or accomplishment of acquiring certain skills, knowledge and attitudes or experiences that are considered worthy and essential for entry, promotion or upgrading on the job.

## Semi-Skilled

This refers to the basic level of competency that are mostly routine, predictable, and uncomplicated tasks. Because of his basic level competency, the semi-skilled person usually needs somebody to oversee and direct his work activities. With diligence, hard-work and willingness to learn on-the-job, a semi-skilled person especially a graduate of at least one-year TVET program, can easily advance to the level of a skilled person.

## Skilled

This is the term for a highly trained or experienced person whose competency in a particular occupation or trade is carried out in a significant and broad scope in various context. A skilled person performs some tasks that are complex or that has some autonomy and individual responsibility and that often requires cooperation with other people in the work environment.



# Competency-Based TVET System

## A. Definition of the Competency Based TVET System

As defined earlier, Competency-Based TVET or the application of CBT in TVET sector is a systematic approach in organizing and providing instruction to develop technical knowledge, skills and attitudes based on industry or competency standards, and then evaluating how well the student demonstrate the knowledge or skills that were taught. The student's ability to demonstrate the technical knowledge and skills determines the mastery or level of competency.

As a system, Competency-based TVET (CBTVET) is a complex undertaking from National policy-making to the institutional level implementation of training, assessment, and awarding of appropriate National-level certification of competency. The system starts with the formulation of a National policy to standardized technical qualifications, and correspondingly based from a national standard of competency in various technological occupation. With the on set of globalization and the fast emerging knowledge-based economy coming-up, the competency-based TVET system has become a powerful training strategy for the country.

## B. The Elements of a Competency Based TVET System

The CBTVET system includes six (6) major elements, and each of these elements has to be undertaken and established to serve as the framework of implementation. These elements include the following:

- a) Establishing National Qualification Framework (NQF) for TVET;
- b) Developing competency standards;
- c) Developing competency-based curriculum;
- d) Developing modules of instruction;
- e) Implementing CBT in TVET institutions;
- f) Assessing the learning outcome, and
- g) Awarding appropriate level of Certification.

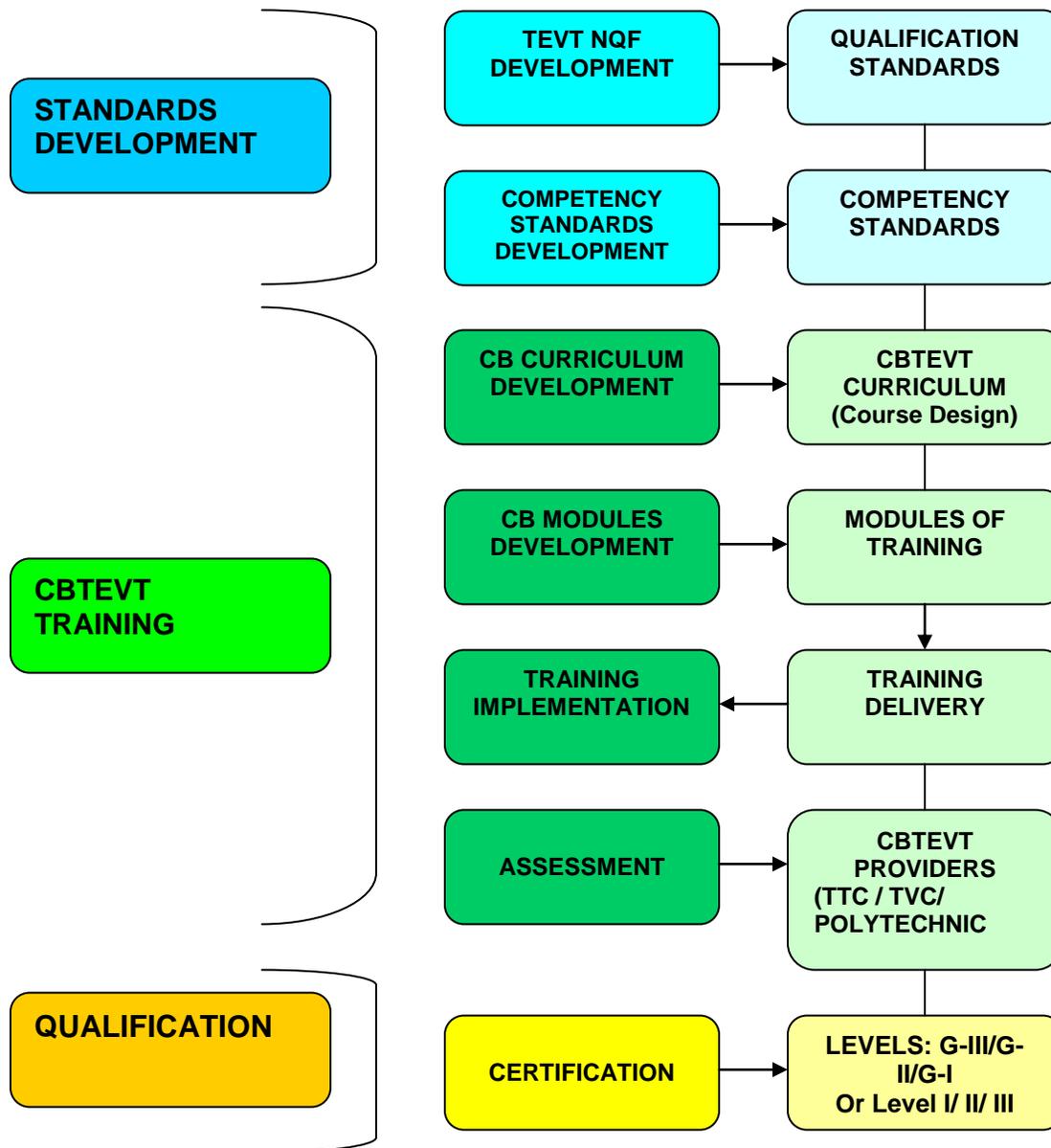
The first three elements are ideally undertaken at the National level since they serve as the bases for the country's policy on the classification and leveling of technical qualifications in the country. The technical or professional qualifications are standardized at the national level to ensure uniformity, stability and integrity of the standard. Likewise, national competency standard is imperative for all technical and professional qualifications to ensure the same characteristics and quality assurance in the country.

Similarly, the development of the CBT curriculum is undertaken at the National level to insure uniformity and common standard of coverage and quality assurance. Together with the curriculum are training regulations in the form of required hours of training; admission



standards; instructional facilities required; suggested approach and methodology of instruction; assessment and certification.

Figure 1 above is a conceptual framework that illustrates the competency-based TVET system.



**Figure 1. Conceptual Framework of Competency-Based TVET System**

Simultaneously considered at this time is the organizational arrangement at the national and regional or provincial levels with respect to the management and control of implementation. The ideal organizational set-up is to organize a new body to carry out the



planning and implementation of CBTVET. But since the provision for TVET has been in place long before the introduction of CBTVET system, it is often more practical to restructure and strengthen the existing National and Regional or provincial organizational structure.

The three other elements are undertaken after the establishment of the National policy on qualification and competency standards mostly at the local and institutional level implementation of the system.



## 1.1 Structure and Levels of Competency in U.K.

As cited in an ILO document, the Levels of Competency as defined in the United Kingdom are as follows:

- Level 1.

“Competency in the performance of a broad scope of labour activities, mostly routine and predictable ones”.

- Level 2

“Competency in a significant and broad scope of Labour activities, carried out in different context. Some of the activities are complex or not routine tasks and there is some autonomy and individual responsibility. It may often require the cooperation with other people, being part of a group or doing team work”.

- Level 3

“Competency in a broad scope of different labour activities developed in a great variety of contexts which are mostly complex and not routine like. There is great responsibility and autonomy and it often requires controlling and providing guidance to other people”.

- Level 4

“Competencies in a broad scope of professional and technically complex labour activities, carried out in a great variety of context and with substantial degree of autonomy and personal responsibility. It may often require being responsible for the work of others and the distribution of resource”.

- Level 5

“Competency which involves applying an important scope of fundamental principles and complex techniques in a broad and sometimes unpredictable variety of contexts. It requires a high degree of personal autonomy and frequently great responsibility regarding the work of others and the distribution of substantial resources. Furthermore, it requires personal responsibility regarding analyses, diagnosis, designing, planning, and implementation and assessment tasks”.

## 1.2 Structure and Levels of Competency in the Philippines

In the Philippines, the Technical Education and Skills Development Authority (TESDA), under the Office of the President, was mandated by law to “formulate a comprehensive development plan for middle-level manpower; ...to ingrate, coordinate and monitor skills development program; and to restructure efforts to promote and develop middle-level manpower, among others. As part of this



mandate, TESDA came up with four (4) levels of competencies for the determination of qualification and certification of technical workers. The four levels of competencies which also serve as National Certificate levels (better known as NC-1, NC-II, NC-III and NC-IV), are operationally defined as follows:

• National Certificate Level I:

- ◇ A worker at this level performs routine and predictable tasks involving little latitude for judgment;
- ◇ Adherence to appropriate standards or specifications are usually involved;
- ◇ Assignments are usually made by supervisors or a worker at a higher level who gives simple instructions and make clarifications or suggestions when necessary.

• National Certificate Level II:

- ◇ A worker at this level performs a prescribed range of functions involving known routines and procedures where clearly identified choices and limited complexities apply;
- ◇ Work involves some accountability for the quality of outputs;
- ◇ Applications at this level may involve individual responsibility or autonomy, or working with others as part of a team or group.

• National Certificate Level III:

- ◇ A worker at this level performs a wide range of skilled operations at a high level competence involving known routines and procedures. The work context involves some complexity in the extent and choice of options available;
- ◇ Work involves understanding the work process, contributing to problem solving, and making decisions to determine the processes, equipment and materials to be used;
- ◇ Applications at this level may involve individual responsibility or autonomy and/or may involve some responsibility for others. Participation in teams including team group coordination may be involved.

• National Certificate Level IV:

- ◇ A worker at this level performs a wide range of applications in a variety of contexts most of which are complex and nonroutine;
- ◇ Work involves some leadership and guidance when organizing activities of self and others as well as contributing to technical solutions of a non-routine or contingency nature. Work at this level also requires evaluation and analysis of current practices and the development of new criteria and procedures;
- ◇ Applications involve responsibility for the organization and performance of others.



### 1.3 Structure and Levels of Competency in New Zealand

The New Zealand Qualifications Authority website presented the following “level descriptors” of competencies adopted in the country’s National Qualifications Framework. The Website described the Level Descriptors as follows: “There are 10 levels involved in the qualification – 1 is the least complex and 10 the most. Levels depend on the complexity of learning. They do not equate to years spent learning, but reflect the content of the qualification”.

LEVEL	PROCESS	LEARNING DEMAND	RESPONSIBILITY
1	<b>Carry out processes that:</b> <ul style="list-style-type: none"> <li>• are limited in range</li> <li>• are repetitive and familiar</li> <li>• are employed within closely defined contexts</li> </ul>	<b>Employing:</b> <ul style="list-style-type: none"> <li>• recall</li> <li>• a narrow range of knowledge and cognitive skills</li> <li>• no generation of new ideas</li> </ul>	<b>Applied:</b> <ul style="list-style-type: none"> <li>• in directed activity</li> <li>• under close supervision</li> <li>• with no responsibility for the work or learning of others</li> </ul>
2	<b>Carry out processes that:</b> <ul style="list-style-type: none"> <li>• are moderate in range</li> <li>• are established and familiar</li> <li>• offer a clear choice of routine responses</li> </ul>	<b>Employing:</b> <ul style="list-style-type: none"> <li>• basic operational knowledge</li> <li>• readily available information</li> <li>• known solutions to familiar problems</li> <li>• little generation of new ideas</li> </ul>	<b>Applied:</b> <ul style="list-style-type: none"> <li>• in directed activity</li> <li>• under general supervision and quality control</li> <li>• with some responsibility for quantity and quality</li> <li>• with possible responsibility for guiding others</li> </ul>
3	<b>Carry out processes that:</b> <ul style="list-style-type: none"> <li>• require a range of well developed skills</li> <li>• offer a significant choice of procedures</li> <li>• are employed within a range of familiar contexts.</li> <li>• in directed activity with some autonomy</li> </ul>	<b>Employing:</b> <ul style="list-style-type: none"> <li>• some relevant theoretical knowledge</li> <li>• interpretation of available information</li> <li>• discretion and judgment</li> <li>• a range of known responses to familiar problems</li> </ul>	<b>Applied:</b> <ul style="list-style-type: none"> <li>• under general supervision and quality checking</li> <li>• with significant responsibility for the quantity and quality of output</li> <li>• with possible responsibility for the output of others</li> </ul>
4	<b>Carry out processes that:</b> <ul style="list-style-type: none"> <li>• require a wide range of technical or scholastic skills</li> <li>• offer a considerable choice of procedures</li> </ul>	<b>Employing:</b> <ul style="list-style-type: none"> <li>• a broad knowledge base incorporating some theoretical concepts</li> <li>• analytical interpretation of</li> </ul>	<b>Applied:</b> <ul style="list-style-type: none"> <li>• with complete responsibility for quantity and quality of output</li> <li>• with possible responsibility for</li> </ul>
LEVEL	PROCESS	LEARNING DEMAND	RESPONSIBILITY
	<ul style="list-style-type: none"> <li>• are employed in a variety of familiar and unfamiliar contexts</li> <li>• in self-directed activity</li> <li>• under broad guidance and evaluation.</li> </ul>	information <ul style="list-style-type: none"> <li>• informed judgment</li> <li>• a range of sometimes innovative responses to concrete but often unfamiliar problems</li> </ul>	the quantity and quality of the output of others



5	<p><i>Carry out processes that:</i></p> <ul style="list-style-type: none"> <li>• require a wide range of specialized technical or scholastic skills</li> <li>• involve a wide choice of standard and nonstandard procedures</li> <li>• are employed in a variety of routine and non-routine contexts</li> </ul>	<p><i>Employing:</i></p> <ul style="list-style-type: none"> <li>• a broad knowledge base with substantial depth in some areas</li> <li>• analytical interpretation of a wide range of data</li> <li>• the determination of appropriate methods and procedures in response to a range of concrete problems with some theoretical elements</li> </ul>	<p><i>Applied:</i></p> <ul style="list-style-type: none"> <li>• in self-directed and sometimes directive activity</li> <li>• within broad general guidelines or functions</li> <li>• with full responsibility for the nature, quantity and quality of outcomes</li> <li>• with possible responsibility for the achievement of group outcome.</li> </ul>
6	<p><i>Carry out processes that:</i></p> <ul style="list-style-type: none"> <li>• require a command of wide-ranging highly specialized technical or scholastic skills</li> <li>• involve a wide choice of standard and nonstandard procedures, often in non-standard combinations</li> <li>• are employed in highly variable routine and non routine contexts</li> </ul>	<p><i>Employing:</i></p> <ul style="list-style-type: none"> <li>• specialized knowledge with depth in more than one area</li> <li>• the analysis, reformatting and evaluation of a wide range of information</li> <li>• the formulation of appropriate responses to resolve both concrete and abstract problems</li> </ul>	<p><i>Applied:</i></p> <ul style="list-style-type: none"> <li>• in managing processes</li> <li>• within broad parameters for defined activities</li> <li>• with complete accountability for determining and achieving personal and/or group outcomes</li> </ul>
7	<p><i>Carry out processes that:</i></p> <ul style="list-style-type: none"> <li>• require a command of highly specialized technical or scholastic and basic research skills across a major discipline</li> <li>• involve the full range of procedures in a major discipline</li> <li>• are applied in complex, variable and specialized contexts</li> </ul>	<p><i>Requiring:</i></p> <ul style="list-style-type: none"> <li>• knowledge of a major discipline with areas of specialization in depth</li> <li>• the analysis, transformation and evaluation of abstract data and concepts</li> <li>• the creation of appropriate responses to resolve given or contextual abstract problems</li> </ul>	<p><i>Applied:</i></p> <ul style="list-style-type: none"> <li>• in planning, resourcing and managing processes</li> <li>• within broad parameters and functions</li> <li>• with complete accountability for determining, achieving and evaluating personal and/or group outcomes</li> </ul>
8	<p><i>Involves skills and knowledge that enable a learner to:</i></p> <ul style="list-style-type: none"> <li>• provide a systematic and coherent account of the key principles of a subject area; and</li> <li>• undertake self-directed study, research and scholarship in a subject area, demonstrating intellectual independence, analytic rigour and sound communication</li> </ul>		
9	<p><i>Involves knowledge and skills that enable a learner to:</i></p> <ul style="list-style-type: none"> <li>• demonstrate mastery of a subject area; and</li> <li>• plan and carry out - to internationally recognized standards - an original scholarship or research</li> </ul>		



LEVEL	PROCESS	LEARNING DEMAND	RESPONSIBILITY
	Project.		
	<ul style="list-style-type: none"> <li>The completion of a substantial research paper, dissertation or in some cases a series of papers.</li> </ul>		
10	<p><i>Involves knowledge and skills that enable a learner to:</i></p> <ul style="list-style-type: none"> <li>Provide an original contribution to knowledge through research or scholarship, as judged by independent experts, applying international standards.</li> </ul>		

#### 1.4 Levels of Competency in Pakistan

In Pakistan, the TVET sector has been using a three-level occupational skill standard for technical workers that is known simply as G-III, G-II, and G-I as the apex level. Developed by the National Training Board in the 1980s, the three-level occupational skills standard for Pakistan is described as follows:

- The Basic Level (Grade-III)

“The Basic level relates to the level of knowledge and skills expected from craftsmen who have undergone training in this trade conducted by a training institution or for those who already have to their credit at least four (4) years of recognized on the job experience”.

- The Intermediate Level (G-II)

“The Intermediate level falls approximately mid-way between the advance level and the basic level”.

- The Advance Level (G-I)

“The Advance level is based on the highest level of knowledge and skills expected from a craftsman in this trade”.

Analyzing the description of this occupational skill standard, it can be noted that the bases of the skill standard (G-III) are the “knowledge and skills expected from craftsmen” and the training provided; or experience in industry for at least four (4) years. The two more advanced levels are described in even more generic terms. In other words, there is a very critical need to review these skill standards in the light of the on-going modernization of the country, and in concert with the on-going restructuring of TVET System. There is a critical need for the skill standards to be operationally defined in terms of competencies that the workers at various levels should be able to perform or demonstrate.



## B. Developing a Competency Standard

### 1. Competency: Types and Elements

**Competency.** As defined earlier, competency is a cluster of related skills, knowledge and attitudes that form part of one's occupation or trade that correlates with and measured by the performance standards set by industry, and that can be developed and improved through training and development. Competencies are tasks performed by workers in industry or world of work in a particular job or occupation. The competency of a person involves his possession and the ability to apply knowledge, skills and attitudes in performing work according to the standard set by industry.

#### 1.1 Types of Competency

Competency experts observe that competencies can be classified into three (3) types, such as basic, common, and core.

**Basic competencies** are related skills, knowledge and attitudes that are simple and fundamental in most jobs, occupation or responsibility in the same level of qualifications. For instance, all G-II craftsmen are expected to “perform simple calculation” or to “prepare all the materials needed for a job”.

Similarly, a G-I worker is expected to “lead a team” or “prepare the scope of work” responsibilities.

**Common competencies** are clusters of related skills, knowledge and attitudes that are similarly performed across a cluster of jobs in a particular trade or occupation and in the same level of qualifications that is expected of the individual in the world of work. While a basic competency is similarly required in most jobs, a common competency is usually restricted in one cluster of occupations. For instance, common competencies in measurements in the area of construction are essentially different from that of mechanical trades, or electronics.

**Core competencies** are the major component of skills, knowledge and attitudes that are mostly applicable for a particular trade, occupation or technology. These are competencies that are applicable only on a particular trade, occupation or technology; or allied trades that are utilizing similar materials.

For CBTVET purposes, the competencies required for a particular technology or occupation and level of qualification are identified and classified into what is termed as “**unit of competencies**”. For each technology, trade or occupation, the unit of competencies are identified and listed under basic, common, and core competencies and each are further analyzed for their major “**elements**”.



## 1.2 The Elements of Competency

The elements of competency are further analyzed to determine the “**performance criteria**” which are useful in the assessment of learning outcomes. The four elements of a competency are as follows:

- **Task skill.** The element of competency that requires performance of the task(s) to the level of standard as prescribed in the unit of competency and expected on the job. In assessing the learning outcome, there is a need to gather evidence that the trainee or student can perform the specific as well as the whole task;
- **Task management skill.** This element captures the skills needed to plan and integrate a number of different tasks to achieve a complete work output. The trainee or student should provide evidence that he can work efficiently to meet deadlines, handle a interrelated tasks, and move on smoothly to complete the whole task;
- **Contingency management skill.** The element of competency that deals with irregularities and breakdowns on the job. The trainee or student must show evidence of managing with contingencies like: breakdowns, irregularities, imperfections, and other unexpected situations;
- **Job environment skills.** The element that deals with the challenges, responsibilities and expectations of the work environment. The trainee or student must demonstrate the ability to work with others and adapt to various situations at the workplace.



# Model of Competency-Based TVET Curriculum for an Industrial Electrician Level 3 / G-I (High Skilled Worker)

**Course Title:** INDUSTRIAL ELECTRICIAN

**Qualification Level :** Level 3/ G-I, (high Level)

**Course Duration:** One School Year and One Summer<sup>4</sup>:

## COURSE DESCRIPTION

Industrial Electrician is an advanced Level program of instruction that is intended to prepare people to become high skilled Industrial Electrician who are competent in meeting the manpower demands of industry, particularly the electrical energy sector. It is intended for individuals who completed Industrial Electrician, Level 2 / G-II, Intermediate Level or a person who holds a Level 2 / G-II Certificate of Qualification in Industrial Electrician who is interested to pursue a study towards a higher level of certification in this field. The course covers basic competencies in safety, communication, and good housekeeping; common competencies on caring and servicing of hand tools, reading electrical symbols and diagrams and drawing interpreting electrical circuits; and core competencies such as performing work on domestic and commercial wiring, protective systems, and installation and maintenance of transformers, electric motors, low to medium size generators, low to medium voltage substation, and power rectifier circuits including maintenance of appliances and equipment. And to fabricate and measure different types of electrical circuits, fabricate different power electronic circuits, operate different electronic gadgets, Install different electrical circuits and machines, design and install control system and maintain electrical installation properly in a manufacturing or processing environment.

The course is highlighted with **on-the-job training** of students in industry to provide actual experience in industry and to enhance their competencies and chances to enter the world of work

## COURSE OUTCOMES

Upon completion of the course the students or trainees must be able to:

1. Observe personal safety and all safety rules and practices;



2. Communicate effectively in the work environment;
3. Maintain good housekeeping and clean work environment;
4. Maintain and service hand tools, measuring tools and equipment;
5. Read symbols and diagrams used for power and protective circuits;
6. Identify and use various types and sizes of cables;
7. Draw circuits and diagrams domestic and commercial installations;
8. Perform electrical wiring in domestic and industrial installations;
9. Perform work on protective system installations;
10. Perform maintenance and service on protective devices;
11. Select, install and maintain transformers;
12. Select, install and service batteries;
13. Select, install, and main different types of electric motors
14. Identify and select portable electric generators
15. Install and maintain a low to medium size generating set
16. Install low and medium voltage substation

<sup>3</sup> Please refer to Footnote No. 1, in Appendix A.

<sup>4</sup> An additional 225 hours (or around 38 days at 6 work hours per day) is required to complete the on-the job (OJT) training of 400 hours.

## ENTRY REQUIREMENTS

- Matriculation Class 10 (Science)/ Industrial Electrician
- Holder of G-II Level 2 Certificate of Qualification Industrial Electrician
- 18 years old and above
- Good moral character
- Can communicate efficiently



## COURSE STRUCTURE (CONTENTS)

Units of Competency	Learning Outcomes	Methodology	Assessment Approach
<b>BASIC COMPETENCIES</b>			
1. Lead workplace communication	1.1 Communicate information about workplace processes. 1.2 Lead workplace discussions. 1.3 Identify and communicate issues arising in the workplace	<ul style="list-style-type: none"> <li>• Group discussion</li> <li>• Role Play</li> <li>• Brainstorming</li> </ul>	<ul style="list-style-type: none"> <li>• Observation</li> <li>• Interviews</li> </ul>
2. Lead small teams	2.1 Provide team leadership. 2.2 Assign responsibilities among members. 2.3 Set performance expectation for team members. 2.4 Supervise team performance	<ul style="list-style-type: none"> <li>• Lecture</li> <li>• Demonstration</li> <li>• Self-paced (modular)</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstration</li> <li>• Case studies</li> </ul>



<p>3. Develop and practice negotiation skills</p>	<p>3.1 Identify relevant information in planning negotiations 3.2 Participate in negotiations 3.3 Document areas for agreement</p>	<ul style="list-style-type: none"> <li>• Direct observation</li> <li>• Simulation/role playing</li> <li>• Case studies</li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Practical/ performance test</li> </ul>
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Units of Competency	Learning Outcomes	Methodology	Assessment Approach
<b>BASIC COMPETENCIES</b>			
<p>4. Solve workplace problem related to work activities</p>	<p>4.1 Explain the analytical techniques. 4.2 Identify the problem. 4.3 Determine the possible cause/s of the problem.</p>	<ul style="list-style-type: none"> <li>• Direct observation</li> <li>• Simulation/role playing</li> <li>• Case studies</li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Practical/ performance test</li> </ul>
<p>5. Use mathematical concepts and techniques</p>	<p>5.1 Identify mathematical tools and techniques to solve problem 5.2 Apply mathematical procedures/solution 5.3 Analyze results</p>	<ul style="list-style-type: none"> <li>• Direct observation</li> <li>• Simulation/role playing</li> <li>• Case studies</li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Practical/ performance test</li> </ul>



6. Use relevant technologies	2.1 Identify appropriate technology 2.2 Apply relevant technology 2.3 Maintain/enhance relevant technology	<ul style="list-style-type: none"> <li>• Direct observation</li> <li>• Simulation/role playing</li> <li>• Case studies</li> </ul>	<ul style="list-style-type: none"> <li>• Written test</li> <li>• Practical/ performance test</li> </ul>
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Units of Competency	Learning Outcomes	Methodology	Assessment Approach
<b>COMMON COMPETENCIES</b>			
1. Apply Quality Standards	1.1 Asses quality of received materials 1.2 Assess own work 1.3 Engage in quality improvement	<ul style="list-style-type: none"> <li>▪ Field trip</li> <li>▪ Symposium</li> <li>▪ Film showing</li> <li>▪ Simulation</li> <li>▪ On the job training</li> </ul>	<ul style="list-style-type: none"> <li>▪ Demonstration &amp; questioning</li> <li>▪ Observation &amp; questioning</li> <li>▪ Third party report</li> </ul>
2. Perform Computer Operation	2.1 Set-up workstation 2.2 Prepare storage media 2.3 Work with files and objects 2.4 Manipulate word processing software 2.5 Manipulate	<ul style="list-style-type: none"> <li>▪ Modular</li> <li>▪ Film showing</li> <li>▪ Computer based training (e-learning)</li> <li>▪ Project method</li> <li>▪ On the job training</li> </ul>	<ul style="list-style-type: none"> <li>▪ Demonstration &amp; questioning</li> <li>▪ Observation &amp; questioning</li> <li>▪ Third party report</li> <li>▪ Assessment of output product</li> <li>▪ Portfolio</li> <li>▪ Computer-based</li> </ul>



	spreadsheet software 2.6 Manipulate customize and database applications 2.7 Utilize the internet Maintain computer hardware and software		assessment
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Units of Competency	Learning Outcomes	Methodology	Assessment Approach
<b>CORE COMPETENCIES</b>			
A. Fabricate and configure different AC circuits	1.1. Configure RL, RC and RLC Circuits 1.2. Connect different types of measuring instruments and Measure different parameters of electricity	<ul style="list-style-type: none"> <li>▪ Film showing</li> <li>▪ Simulation</li> <li>▪ On the job training</li> <li>▪ Practical Demonstration</li> </ul>	<ul style="list-style-type: none"> <li>▪ Demonstration &amp; questioning</li> <li>▪ Observation &amp; questioning</li> <li>▪ Third party report</li> </ul>
B. Fabricate different power electronic circuits	1.1 Identify different type of electronic components. 1.2 Prove the characteristic of semiconductors components. 1.3 Connect the diode and check the operating	<ul style="list-style-type: none"> <li>▪ Simulators</li> <li>▪ Film showing</li> <li>▪ Computer based training (e-learning)</li> <li>▪ Project method</li> <li>▪ On the job</li> </ul>	<ul style="list-style-type: none"> <li>▪ Demonstration &amp; questioning</li> <li>▪ Observation &amp; questioning</li> <li>▪ Third party report</li> <li>▪ Assessment of output product</li> <li>▪ Portfolio</li> </ul>



	<p>behavior of PN, NP, NPN and PNP junction in circuit.</p> <p>1.4 Construct and measure rectifier circuit (Half wave and Full wave).</p> <p>1.5 Construct and measure Bridge rectifier Power supply.</p> <p>1.6 Construct and measure voltage regulated Power supply with Zener diode.</p> <p>1.7 Practically check the function of transistor and make circuit.</p> <p>1.8 Construct and measure voltage regulated Power supply with IC 7806.</p> <p>1.9 Construct and measure voltage regulated Power supply Transistorized.</p> <p>1.10 Construct and measure Emitter follower.</p> <p>1.11 Construct and measure multistage feedback amplifier.</p> <p>1.12 Construct and measure Push pull power</p>	<p>training</p>	<ul style="list-style-type: none"> <li>▪ Computer-based assessment</li> </ul>
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	<p>amplifier.</p> <p>1.13 Construct and measure RC sine wave oscillator.</p> <p>1.14 Measure the characteristics of UJT and circuit.</p> <p>1.15 Measure the characteristics of SCR and circuit.</p> <p>1.16 Measure the characteristics of diac and circuit.</p> <p>1.17 Measure the characteristics of Triac and circuit.</p> <p>1.18 Making and measurement of flip-flop circuit.</p>		
<p><b>C. Operate different Electronic Gadgets</b></p>	<p>1.1 Solving of number system i.e. Binary, Octal, Hexadecimal and Decimal.</p> <p>1.2 Operate Analogue and digital signal.</p> <p>1.3 Pin connection digital lcs.</p> <p>1.4 Check basic digital gates, i.e. AND, OR and NOT..</p> <p>1.5 Checking of secondary digital gates, i.e. NAND, NOR, ExOR and ExNOR.</p> <p>1.6 Demonstrate Combination of digital gates.</p> <p>1.7 Operate Digital memories PLCs</p>	<ul style="list-style-type: none"> <li>▪ Lecture / Demonstration</li> <li>▪ Distance education</li> <li>▪ Film Showing</li> </ul>	<ul style="list-style-type: none"> <li>▪ Written/Oral examination</li> <li>▪ Practical demonstration</li> </ul>



<p><b>D. Install Industrial Electrical Circuits</b></p>	<p>1.1 Prepare the Electrification map 1.2 Transfer layout of E-map to the site 1.3 Select Appropriate Electric cables/wires, proper flux and joining material 1.4 Install Main Panel and Sub-panel boards 1.5 Install Isolators 1.6 Install 3. Pole MCB, 3 Pole MCCB 1.7 Install Industrial Sockets 1.8 Install Earth Electrodes 1.9 Connect L.T cable to Transformer</p>	<ul style="list-style-type: none"> <li>▪ Self- paced/ modular</li> <li>▪ Demonstration</li> <li>▪ Small group discussion</li> <li>▪ On the job training</li> <li>▪ Distance education</li> </ul>	<ul style="list-style-type: none"> <li>▪ Written/Oral examination</li> <li>▪ Practical demonstration</li> </ul>
<p><b>E. Install Electrical Machines</b></p>	<p>1.1 Install different type of transformers 1.2 Repair and Maintain Transformers 1.3 Select appropriate motor 1.4 Install and operate DC Motors and Generators Operate Single phase and 3-phase AC motors</p>	<ul style="list-style-type: none"> <li>▪ Lecture/ demonstration</li> <li>▪ Dualized</li> <li>▪ Distance learning</li> </ul>	<ul style="list-style-type: none"> <li>▪ Written /oral examinations</li> <li>▪ Direct observation</li> <li>▪ Project method</li> <li>▪ interview</li> </ul>
<p><b>F. Design Control System</b></p>	<p>1.1 Estimate Elements Quantity 1.2 List down I/O details 1.3 Select sensors and actuators 1.4 Check Control System and Network requirements 1.5 Design the Power Circuit and Produce the Diagram 1.6 Check Control System and Network requirements</p>	<ul style="list-style-type: none"> <li>▪ Film Viewing</li> <li>▪ Individualized Learning</li> <li>▪ Direct Student Laboratory Experience</li> <li>▪ On the Job Training</li> <li>▪ Project Method</li> </ul>	<ul style="list-style-type: none"> <li>▪ Demonstration and Questioning</li> <li>▪ Assessment of Output Product</li> </ul>
<p><b>G .Install Control system</b></p>	<p>1.1 Install different control System for Electric Motor 1.2 Fix Magnetic Contactors and electronic components</p>	<ul style="list-style-type: none"> <li>▪ Film Viewing</li> <li>▪ Individualized Learning</li> <li>▪ Direct Student</li> </ul>	<ul style="list-style-type: none"> <li>▪ Demonstration and Questioning Assessment of</li> </ul>



	<p>in Control Circuit</p> <p>1.3 Install Power Circuit according to the Diagram</p> <p>1.4 Install safety devices</p> <p>1.5 Trace faults in the circuits</p>	<p>Laboratory Experience</p> <ul style="list-style-type: none"> <li>▪ On the Job Training</li> <li>▪ Project</li> <li>▪ Method</li> </ul>	<p>Output Product</p>
<p><b>H. Mainten and Repair Electrical Machines and Install Ations</b></p>	<p>1.1 Operate and check different installation with Measuring Instruments</p> <p>1.2 Keep Record of all machines</p> <p>1.3 Undertake Earthling and Insulation Test</p> <p>1.4 Assemble and disassemble motors</p> <p>1.5 Oiling and greasing different parts</p>	<ul style="list-style-type: none"> <li>▪ Film Viewing</li> <li>▪ Individualized Learning</li> <li>▪ Direct Student Laboratory Experience</li> <li>▪ On the Job Training</li> <li>▪ Project</li> <li>▪ Method</li> </ul>	<ul style="list-style-type: none"> <li>▪ Demonstration and Questioning Assessment of Output Product</li> </ul>

## METHODOLOGY OF COURSE DELIVERY

**1. Modular approach.** The course contains a series of modules of instruction that requires a combination of student-focused and teacher-centered approaches, and that culminates with assessment of learning outcomes.

**2. Demonstration method.** New skills lessons must be demonstrated to show the right way or procedure of doing things that will be followed by repeated practice to develop mastery of the skills.

**3. Lecture method.** The Lecture method combined with questioning and discussion will be used in teaching the theories and principles or the technical knowledge portion of each module.

**4. Discussion method.** The lecture method should be extensively used to develop the ability to articulate one's ideas and to explain theories and principles clearly.

**5. Project method.** It will be used to develop mastery of skills by giving assignment to students to make a useful project that will require the execution of practical lessons and problem solving.



**6. Assignment method.** This will be used to give opportunity for students to carry out additional study the Learning Resource Center, and through on-line search.

**7. On-site practice.** Whenever possible, students will be assigned to work on-site, to develop competency on domestic or industrial wiring installation.

**8. Industry visit.** Industry visit will be used also to give students the opportunity to see and have a feel of the actual work environment.

**9. On-the-Job Training (OJT).** This is actual placement of students in industry for at least three (3) months or 400 working hours. The OJT will provide actual work experience in a real work environment to apply what is learned in school and to learn new knowledge, skills and attitudes that can be learned only in industry.

## ASSESSMENT METHOD

**1. Written examination.** A written test will be administered at the end of every module and at the end of the course, to evaluate learning outcomes on the theoretical aspects of the course.

**2. Demonstration of practical skills** This assessment method will be used to determine whether or not the student can perform the competencies according to industry standard. This will be used also to check if remedial or additional inputs are required for the student to develop a mastery of the lesson taught.

**3. Direct observation.** Observation is an important approach in assessing the attitude of the students toward work, observance of safety rules and regulations, and how they interact and relate with other students and teachers.

**4. Interview.** Interview may be also used to verify their knowledge of principles and theories; or to check if they could explain the working principles of some job processes or equipment or machines.

## QUALIFICATION OF INSTRUCTORS

- Bachelor's degree in Electrical Engineering or Bachelor of Technology in Electrical
- 5 Years of TVET teaching experience with G-1 Certificate of Competency

## MEMBERS OF THE REVIEW COMMITTEE

Grateful acknowledgement is hereby extended to the following members of the Committee of Experts created by the Skills for Employability SFE Project, for converting GCT Nowshera into Centre of Vocational Excellence & Restructuring of Technical Education and Vocational Training Systems , Ministry of Industries, Labor and Manpower, Government of K.P.K., who reviewed and suggested improvements of the Contents (competency elements) of this Model CBT curriculum during the SFE Project held at the Government College of Technology, Nowshera, K.P.K., Pakistan:



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