Handbook on the Development of Dualized Core Curriculum and Training Plan

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Developed by TESDA NITVET – CTAD
in Partnership with
the TESDA – Office of Apprenticeship and
the TESDA–GTZ Project

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Foreword

The **Handbook on the Development of Dualized Core Curriculum and Training Plan** is the product of developmental efforts undertaken by the Technical Education and Skills Development Authority (TESDA) to further encourage the wider implementation of dual training system (DTS) and dualized training (DT) programs in the Philippines. Essentially, the Handbook is a compilation of information materials and worksheets developed for and used in a series of regional workshops on the theme: 'Pilot implementation of a Dualized Curriculum', which was jointly conducted by the National Institute of Technical Vocational Education and Training (NITVET), the office of Apprenticeship (OA), the TESDA–GTZ Project, and the Center for International Migration (CIM) Consultant detailed at NITVET.

The Handbook is produced, on the main, to pave the way for the replication of the experiences and learning gained at the regional workshops cited above in the rest of the TESDA regions and in the entire technical–vocational education and training (TVET) sector. Current and prospective implementers of DTS and DT programs throughout the country, including school administrators, school instructors, industrial coordinators, and industrial trainers, among others, are expected to benefit from the use of this Handbook particularly in the important area of curriculum and training plan development for DTS and DT programs within the context of current TESDA reform initiatives.

Presented in the Handbook are the simple and easy–to–follow procedures for developing dualized core curricula and training plans based on TESDA–approved Training Regulations for specific occupations. To illustrate these procedures, a prototype dualized core curriculum and a prototype training plan for Plant Maintenance Mechanic have been provided as models. With these procedures and model as guides, and complemented by the relevant Training Regulations, Handbook users will be assisted every step of the way in developing their needed dualized core curricula and training plans for various tech–voc courses.

With this Handbook on hand, it is our hope that the widening utilization of DTS and DT programs in schools/training centers and private companies throughout the country will be facilitated. For, indeed, a dualized core curriculum, with its accompanying training plan, offers a vital document in negotiating for prospective partnerships in dual training.

The Handbook has been completed through the collaborative efforts of a number of organizations, offices and individuals. In particular, the following deserve special mention –Mr. Antonio C. Solanoy, TESDA, NITVET–CTAD; Prof. Rudolf Tippelt, University of Munich; Mr. Jürgen Schwarz, TESDA, NITVET–CTAD, CIM Consultant and, Mr. Lorenzo F. Templonuevo, TESDA–GTZ Project. To each of them goes our deep appreciation and thanks.

Lucita S. Lazo
Director General, TESDA

Part A: Dualized Core Curriculum and Training Plan: Understanding the Terms

This introductory section provides the Handbook user with a quick yet comprehensive explanatory notes on the usage and meanings of the two (2) key terms – *dualized* **core curriculum** (DCC) and *dualized* **training plan** (DTP). This is seen necessary if only to ensure that the terms, as well as their specific use in this Handbook, are rightfully understood by the Handbook users, especially those who will eventually use these terms in the field. The section opens with a basic model (Figure 1) that identifies the different foundational concepts, which provide the contextual basis in the evolution of the two terms under consideration. Background discussions on each of these foundational concepts –Competency–Based Education (CBE), Competency–Based Technical Education and Skills Development (CBTESD), Training Regulations (TR), and Dual Training System (DTS) –take the most part of the section. The provision of basic working definitions of the two (2) key terms ends this part of the Handbook.

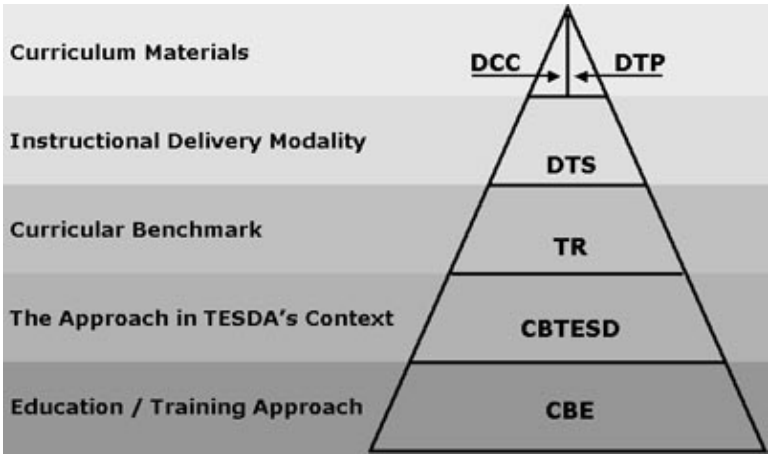


Figure 1. The Dualized CC/TP Conceptual Pyramid

The **Dualized CC/TP Conceptual Pyramid** indicates that CBE, regarded as one of the most significant and innovative educational and training approaches ever to be developed within the last fifty years and is now embedded in TESDA's platform to strengthen the TVET sector, provides the fundamental base for the development of dualized CCs and TPs, it being the education/training approach now endorsed by TESDA. Conceptualizing CBE in the context of TESDA, in turn, yields the concept CBTESD, which then gives impetus to the need for developing a TR. A TR provides curricular benchmarks for a particular technology–based course developed and offered in the country. DTS (or its dualized variant), for its part, is one of the seven (7) technical education and skills development reform strategies and is TESDA's preferred modality of instructional delivery for TVET.

It is this endorsement of the offering of DTS and dualized training (DT) programs that necessitates the development and use of dualized CCs and TPs.

INPUTS ON THE CONCEPTS

• ***Competency–Based Education (CBE)*** is fast gaining popularity as a highly–effective approach to improving and/or delivering instruction worldwide. A vocational education movement, which began in the USA and Canada, CBE's primordial concern may be casually expressed as follows:

"What is most important is not where you studied, or how long you studied, or even how you learned. What matters most is – ***Did you really learn?****"*

The ultimate test of whether one really has learned is his/her demonstration of the skills that were supposed to have been learned. An initial proof of this, in the case of a technical–vocational course student/graduate, is the passing of a competency assessment (or more popularly referred to in the past as *trade test* administered and certified by a competent body, e.g. TESDA, which is both recognized by the employers and the training providers. CBE's instructional methodologies tend to be modularized, more flexible and learner–centered.

As an alternative to the conventional approach to instruction, CBE capitalizes on the facilitation of effective and efficient learning, which is relevant to the real world of work, by employing the learning principles of motivation, individualization, reinforcement of learning, self–pacing, recognition of different learning styles, provision of frequent feedback, opportunities for practice, and active participation. Its basic philosophy is:

"Almost all learners can learn equally if they receive the kind of instruction they need."

Central to the understanding of CBE is the knowledge of what competencies are. Competencies are a description of the essential skills, knowledge and attitudes required for effective performance in a work situation. Essentially, they detail the outcomes of work and are commonly stated in terms of duties and tasks of specific occupations.

To make CBE work, the approach uses a very systematic procedure in developing, implementing and delivering training. The approach can be said to have four (4) essential features as follows:

1. Learning outcomes (or competencies), which are published, are specified in measurable terms;

2. These outcomes are determined before the learning process begins through the analysis of the occupation or the occupational area;

3. The mastery of these outcomes is the criterion of success of the learning process and a learner has to perform up to a predefined standard; and

4. Admission to the assessment procedure is independent of the time spent in the learning process or the mode of learning. CBE recognizes prior learning. As such, it opens the assessment procedure even to people who have not taken part in any formal education but feel that they are able to demonstrate the required competencies.

• ***Competency–Based Technical Education and Skills Development (CBTESD)*** is the term used to describe TESDA's way of adapting the CBE and the Modules of Employable Skills (MES), the latter being a vocational approach popularized by the International Labor Organization (ILO). As a resultant adaptation, CBTESD becomes most responsive to the needs of TESDA's clientele in the aspect of international competitiveness, private sector requirements, government reforms, education and training reforms, technology advances, quality management, and multi–skilling demands. Operationally, the Authority is able to respond to its customers' needs by setting up a well defined TESDA Occupational Qualification and Certification System (TOQCS), which will serve as benchmarks for technical and vocational education and skills training; curriculum development; training materials development; accreditation; industry training recognition; registration and monitoring of training providers; assessment of learning; and certification of company.

CBTESD, as an instructional program, derives its content from verified and validated tasks (or competencies) and bases assessment on student performance. Learning materials used in these programs identify, verify, and publish, before the actual start of training, the tasks the student would learn and perform during the training and eventually at work. The criteria with which the student will be evaluated, and the conditions under which the evaluation will occur are also made known to trainees ahead of training time. Instruction emphasizes the ability to do as well as knowing the how and why. Student performance and knowledge are evaluated individually against stated criteria, rather than against group norms.

There are 12 factors that differentiate a traditional technical and vocational program with a CBTESD program. The differences are enumerated in Table 1.

Table 1.
Differences Between Traditional and CBTESD Program

Traditional Program	CBTESD Program
Content−based	Competency−based
Time−based	Performance−based
Group−paced	Individually−paced
Group−needs	Individual−needs
Delayed Feedback	Immediate Feedback
Textbook/Workbook	Modules and Media Materials
Limited Field Experience	Learning in the Field
Lectures/Demonstration	Assistance of Resource Person
General Objectives	Specific Objectives
Subjective Criteria	Objective Criteria
Norm−referenced	Criterion−referenced
Final Grades	Learner Competence
Traditional Program	CBTESD Program

In summary, the five (5) essential elements and seven (7) desirable characteristics of CBTESD are given below:

Essential Elements

1. Competencies to be achieved are carefully identified, verified, and made public in advance;

2. Criteria to be used in assessing achievement and the conditions under which achievement will be−assessed are explicitly stated and made public in advance;

3. The instructional program provides for the individual development and evaluation of each of the competencies specified;

4. Assessment of competencies takes the learner's knowledge and attitudes into account but requires actual performance of the competency as the primary source of evidence; and

5. Students/Trainees progress through the instructional program at their own rate by demonstrating the attainment of specified competencies.

Desirable Characteristics

1. Instruction is individualized to the maximum extent possible, rather than group based;

2. Learning experiences are guided by frequent feedback;

3. Emphasis is on helping the learner achieve program exit requirements;

4. Instruction is individually paced rather than time−based;

5. Instruction is, to a considerable extent, field−centered − based on realistic work problem and situations;

6. Instruction is often modularized and uses materials with both required and optional learning activities to help achieve flexibility and provide for different learning styles; and

7. The program as a whole is carefully planned and systematic.

TESDA's CBTESD training programs are developed using a series of four (4) interconnected processes, namely,

occupational analysis (the process by which the duties and tasks of an occupation or job are identified and verified through a DACUM process),

task analysis (the process by which the standards are being identified, verified and validated by the Experts),

instructional analysis (the process by which curriculum outline and training pathway is being designed based on the standards derived from the task analysis), and

instructional design and development (the process of developing the instructional outline and instructional materials or modules to be developed).

The first two (2) are necessary for the development of what is called a Training Regulation. On the basis of the Training Regulation developed, the last two (2) processes are undertaken to design and develop a technical and vocational training program, particularly the dualized core curriculum and training plan of a DTS/DT program.

• ***Training Regulation (TR)*** –a TESDA Board–approved document prescribing the minimum standards for training to bring about experts–identified competencies in a particular occupation. These competencies have been identified by qualified representatives of the TESDA Technical Advisory Panel (TAP) and the Technical Experts Panel (TEP). The document consists of two (2) parts –

occupational skills standard (defines the minimum required stock of knowledge and skills an individual is supposed to possess to qualify as an operator, a craftsman, or a technician, who are granted equivalent national skills certificate under a particular occupational title), and

training standard (defines the minimum training program requirement in terms of the occupation–holder's duties and tasks, entry requirements of trainees, trainers' qualifications, equipment and tools needed, and shop layout, among others).

A TR is developed primarily out of a job analysis initiative. Job analysis may be done using a number of methods and techniques including job observation, interview and use of questionnaire. In the Philippines, however, the DACUM (Developing A Curriculum) is the more popular job, analysis methodology used for identifying duties and tasks of occupations.

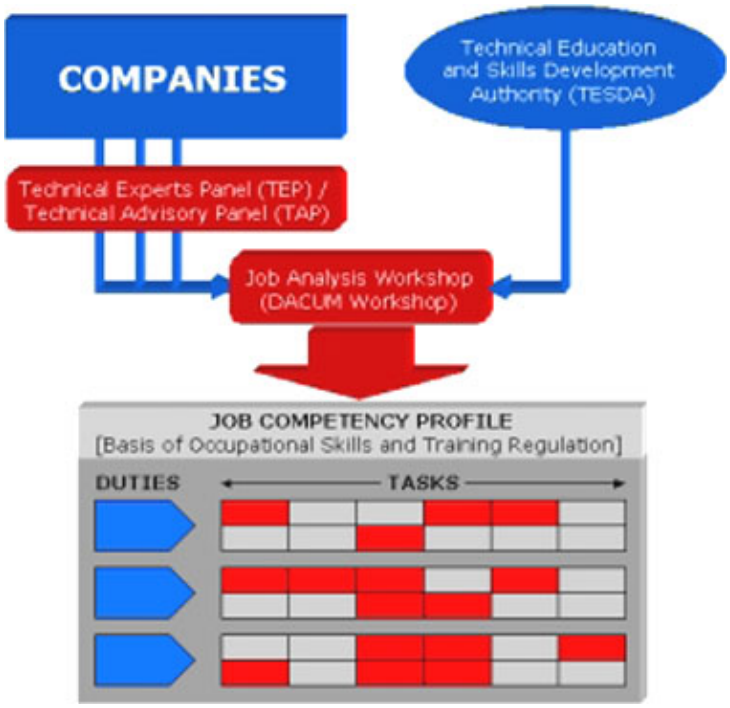


Figure 2. Development of a Job Competency Profile – JOB ANALYSIS

The tasks identified in job analysis are, in fact, the competencies that are expected of an employee to do in a particular occupation at the workplace. In a CBE/CBTESD training program, therefore, the focus is the development of these competencies among the student–trainees who will be making use of them (competencies) later in their employment life. This makes CBE/CBTESD, with its attendant TRs, an outcome–oriented system (Figure 4). The range of competencies addressed in a CBE/CBTESD training program usually include: (1) Performance of individual tasks (technical competency); (2) Management a number of different tasks within the job (managerial competency); (3) Responsiveness to irregularities and breakdowns in routine (problem solving competency); and (4) Dealing with the responsibilities and expectations of the work environment, including working with others and teamwork (personal and social competencies).

Figure 2 shows how TESDA collaborates with companies in the development of a Job Competency Profile of a certain occupation.

Figure 3 shows how each task in the Job Competency Profile is analyzed to produce a Task Profile.

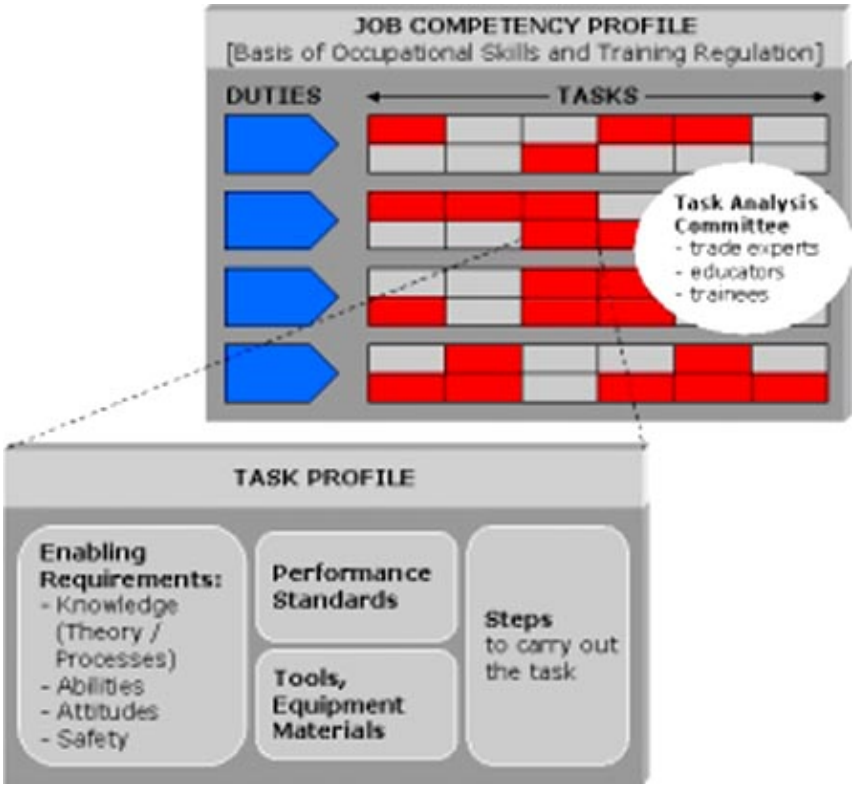


Figure 3. Development of a Task Profile – TASK ANALYSIS

• ***Dual Training System (DTS)*** –The DTS is a special type of delivery system in TVET that combines two places of learning –the school/training center and the production plant of an agricultural, industrial or business establishment. The DTS Act of 1994 (RA 7686) was signed into law on February 25, 1994 to encourage schools and establishments to utilize the DTS in TVET by providing incentives and clear guidelines on its implementation.

The DTS implementation entails the close coordination between the school and the establishment. They prepare a training plan, identify training stations, establish a joint training agreement, and assign an industrial coordinator.

Conceptually, DTS involves two (2) venues of learning: the school and the factory or workplace. It exposes trainee to the actual work situation and forms him/her on the proper values/attitudes required by the company. It also assures that returns of investments on the training program and the trainee is faster than any skills/technical training program or training arrangements available in the market.

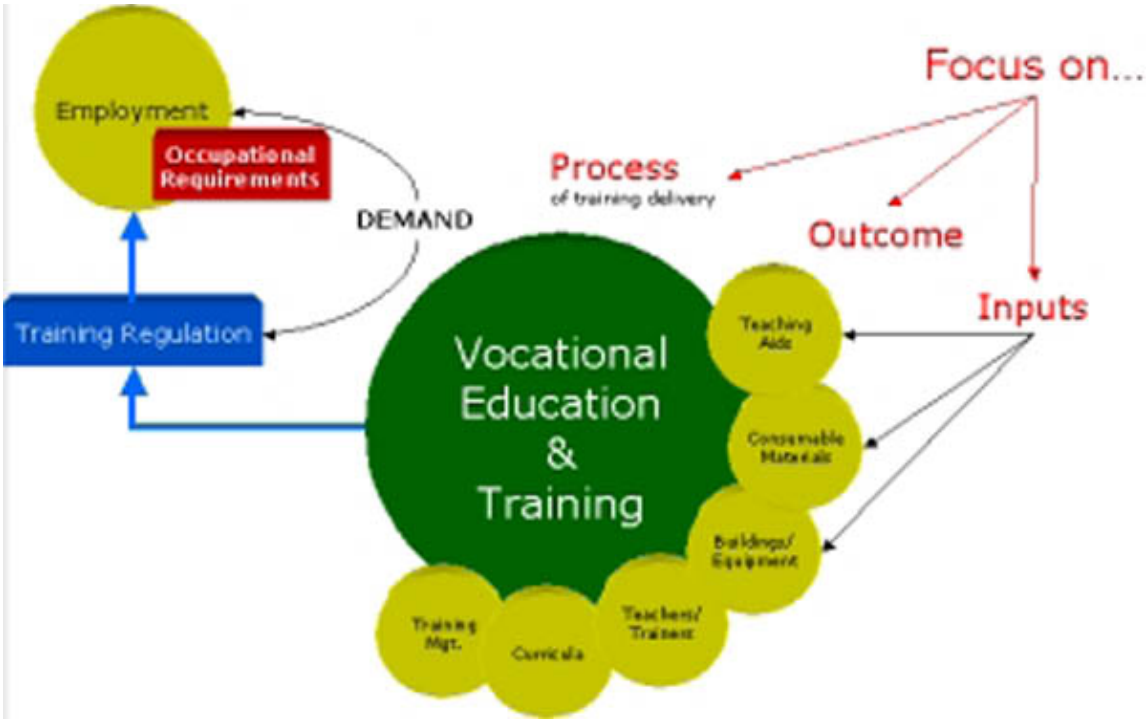


Figure 4. Training Regulation as the Result of an Outcome–Oriented System

Following the concept of CBE/CBTESD, the DTS is also an ***outcome–oriented system***. Its aim is to come up with quality–trained individuals who are equipped with the competencies required at the workplace for a particular occupation. For this to be assured, DTS and/or dualized training programs' curricula and training plans need to be developed using the relevant TRs developed and approved by TESDA for the occupations concerned. This ultimately gives birth to the terms ***dualized Core Curriculum (DCC)*** and ***dualized Training Plan (DTP)*** to simply mean a core curriculum and a training plan developed for any dual training program (DTS and DT*, alike).

> * *DT, referring to TVET courses which have improved and/or strengthened one or more of its specific elements to grow in conformance with the provisions of the DTS Law.*

• ***Dualized Core Curriculum (DCC)*** –DCC is a core curriculum intended to be used for a DTS or a dualized training program. The word 'core' in the term means 'skeletal', which suggests that the curriculum document is meant to be viewed and used as a basic or minimum framework for training (and education), which can be further enriched and expanded collaboratively by the school and a company partner to make it more responsive to the latter's actual workplace requirements.

• ***Dualized Training Plan (DTP)*** –DTP is a training plan collaboratively designed by a school and a company partner for purposes of offering a DTS and/or a dualized training program.

Part B: Guidelines for Developing a Dualized Core Curriculum Introduction

Before tackling the specific task of developing a dualized core curriculum, it might be helpful to put the task in the context of a broader process of developing a dualized competency–based curriculum. This is particularly necessary in the light of the implementation of a reform in technical–vocational education and training called the Unified TVET Programs Registration and Accreditation System (UTPRAS). UTPRAS requires that the curricula of training programs to be registered are competency–based. This being the case, it becomes critically important that the curricula of training programs that will adopt the dual training approach be competency–based already in order to facilitate their registration under UTPRAS.

DEVELOPMENT OF DUALIZED COMPETENCY–BASED CURRICULUM

Figure 5 summarizes the entire process of developing a dualized competency–based curriculum.

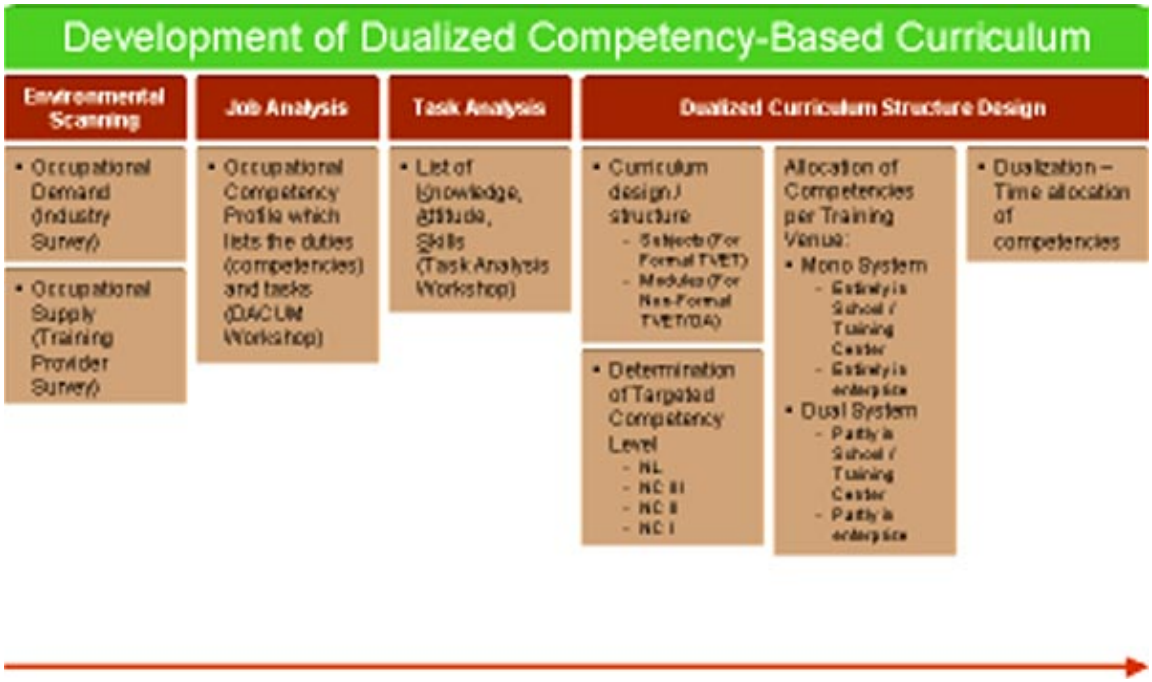


Figure 5

The process begins with an environmental scanning exercise that aims to ascertain the relevance of the occupation/s that the course to be dualized will address. This exercise is two–fold. Firstly, the occupational demand, which can be done through an industry survey, and secondly, the occupational supply, which can be accomplished through a training provider survey. When the industry demand for the occupation/s is far greater than what the existing training providers can supply, then this offers a good situation for the school/training center concerned to offer the envisioned training program.

Once the situation that warrants the offering of the envisioned training program is ascertained, then the job competencies of the occupation/s concerned should be determined. This is to be undertaken using any of the more popular and efficient job analysis approaches, one of which is the Developing A Curriculum (DACUM) workshop. Conducted under the expert facilitation of a trained DACUM Facilitator, this workshop is able to identify the competencies of the occupation/s concerned in terms of duties and tasks by outputting a Competency Profile Chart or a DACUM Research Chart. It should be pointed out here that the job analysis effort may be done away with in cases of occupations where TESDA has existing Training Regulations already. This is simply because the Training Regulations already contain the competencies (duties and tasks), which actually becomes the building blocks of the dualized/DTS competency–based curriculum.

After determining the duties and tasks (competencies) of the occupation/s concerned, task analysis is to be undertaken. This process is concerned with the elaboration of each task into steps and the identification of knowledge, skills and attitudes that are essential in the successful performance of the competencies required by the occupation. Again, with the availability of the relevant TESDA Training Regulations (TR) task analysis, just like job analysis, becomes unnecessary since the outputs of task analysis are already contained in the TR. Once these knowledge, skills and attitudes are listed, the designing of the dualized curriculum structure is given way next. In the context of the formal TVET sub–sector, the necessary subject titles are identified that serve as fundamental inputs into the preparation of the curriculum structure. Meanwhile, in the Non–Formal TVET/OA sub–sector, the modular units of competencies are determined for use in the structuring of the curriculum framework. This stage should likewise concern itself with the determination of targeted competency/qualification levels e.g. NC I (National Certificate), NC II (National Certificate 2), NC III (National Certificate 3), and NL (National Licence).

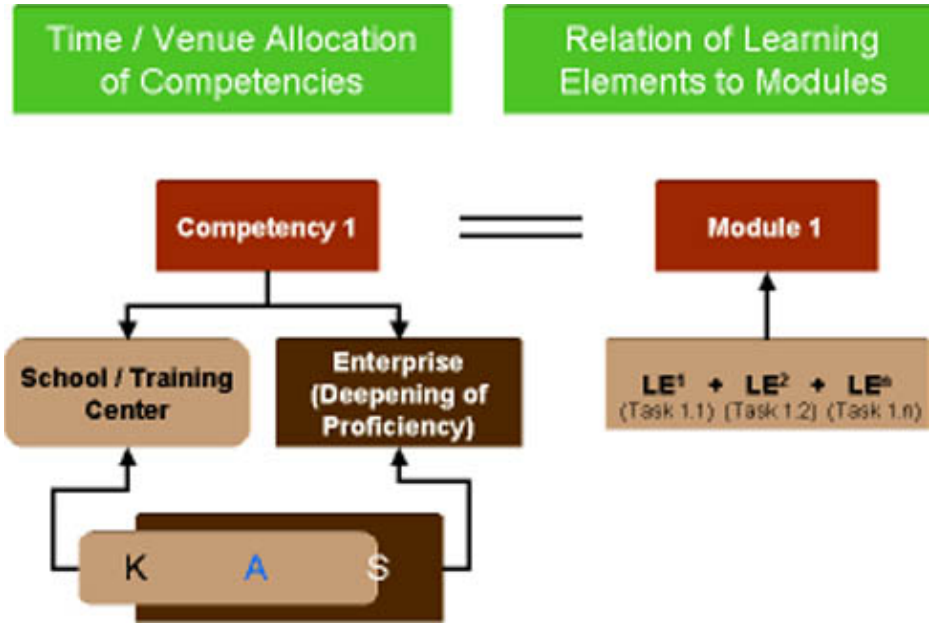


Figure 6

The process of allocating time and training venues for each of the competencies concerned becomes the next responsibility of the curriculum developer.

Figure 6 conveys in graphical terms three (3) important concepts as follow:

1. In allocating time and assigning venue for each competency, it is worth remembering that knowledge and attitude and the basic skills are to be offered in the school/training center. In turn, the attitude and advanced skills and partly of knowledge are to be emphasized in the enterprise where the proficiencies are expected to be deepened.

2. In the modularized instruction under the competency–based technical education and skills development, a competency (see Figure 7) will correspond to a module.

3. Each module will be elaborated with a number of learning elements that individually will correspond to a task under the duty being addressed by the module concerned.

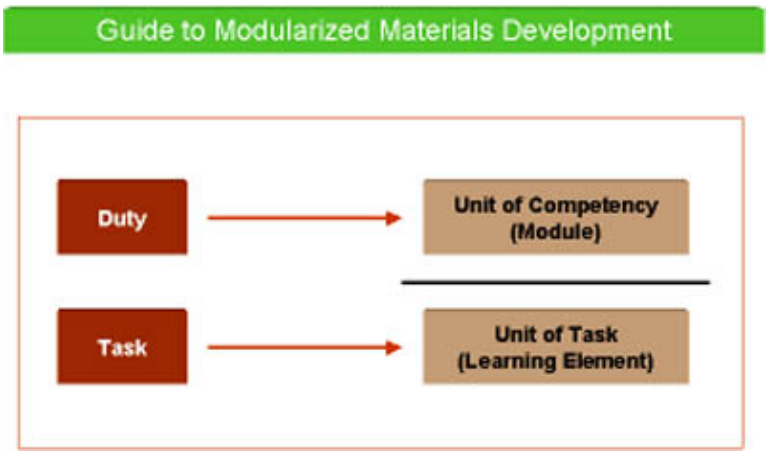


Figure 7

THE DUALIZED CORE CURRICULUM

The dualized Core Curriculum (DCC) provides the following information about the course –

- Training Content Coverage
- Duration Allotment (in Hours and in Days)
- Knowledge Requirements (listed as TOPICS in Part 1 of DCC)
- Skills Requirements (listed as DUTIES in Part 2 of DCC)

– in addition to such background information as: sector, occupation field, manpower level, course title, national certificate classification, and duration (for the course in total and for course's Parts 1 and 2).

PROCEDURE FOR DEVELOPING A DCC

There are basically three (3) steps in developing a DCC. These are:

1. State knowledge and skills requirements in terms of TOPICS and DUTIES, respectively;

2. Allot duration in terms of hours and days per TOPIC and DUTY; and

3. Assign the length of time to be spent in the school/training center (in both the classroom and the workshop) and in the company.

The following section explains in some detail each of these steps.

Step 1: **State Knowledge and Skills Requirements**

The TESDA–approved Training Regulation (TR) for the occupation concerned becomes the most valuable resource in the execution of this initial step. This is because the TR already provides an Index of Knowledge Requirements as well as an Index of Skills Requirements of a particular occupation. This being the case, all that has to be done is to list the major headings of the knowledge requirements provided for in the TR as TOPICS and the major headings of the skills requirements provided for in the TR as DUTIES. For a greater appreciation of the implementation of this step, please refer to Worksheet 2: Developing a Core Curriculum for Knowledge Requirements (pages 1 & 2) and Worksheet 3: Developing a Core Curriculum for Skills Requirements (pages 1 & 2).

Step 2: **Allot Duration Per Topic and Duty**

The time allotted to the topics and the duties stated in Step 1 are determined on the basis of the following considerations:

• The importance (as indicated by frequency of encounter) of the topic/duty within the work process. Major topics/duties require longer time and more intensive training;

• The degree of difficulty (simplicity or complexity) of the topic/duty. The more complex and difficult a topic/duty is, the longer time and more intensive training it requires (even if the topic/duty is a subsidiary element only of the occupation); and

• The content of previous training phases already undergone by the trainees. New topic or duty, which has not been covered in previous training phases, requires longer time and more intensive training.

Step 3: **Assign Time Duration for In–School and in–Company Training**

The DCC format presents the following:

- Training program's topics (for Part of DCC that reflects the knowledge requirements);
- Duties (for Part 2 of DCC that reflects the skills requirements);
- Duration of each topic or duty; and
- Training venue (school/training center classroom, school/training center workshop, or company).

NOTE:

Appropriate Worksheets (Nos. 1, 2 and 3) have been designed and provided for in this publication to assist the DCC–developer to go through this procedure step–by–step. Please see the Handbook's Worksheets section beginning on page 64

To determine the appropriate training venue for each topic or duty, these simple guidelines may be considered for use. Topics (knowledge requirements) are largely imparted to the students at the school/training center. Duties (skills requirements), in turn, are normally imparted in both the school/training center workshop (for basic skills training) and in company (for advanced skills).

OTHER CONSIDERATIONS

In the assignment of learning venues for topics and duties, there are two (2) ways to choose from. The first is the block system (or block–release scheme, as referred to by some literature) where the basic topics and skills are imparted full time in the school/training center's classroom and workshop during the initial block of the course. The remaining and more advanced block is spent for the most part in the company. The second option is the rotation system (or day– release scheme) where definite number of days in a week are assigned for in– school/training center training and in–company training. For example, five (5) days may be assigned for in–company training and one day may be for in–school training.

The topics and duties of a DCC are chronologically presented in accordance with levels of difficulty (from easy to difficult), complexity (from simple to complex) and specificity (from basic to specific) with the qualification and certification level (e.g. Level 1, Level 2, Level 3, etc.) that they correspond to thus ensuring that the acquisition of skills follows a systematically arranged structure.

APPLICATION

As already mentioned earlier, Worksheets 1, 2, and 3 will prove very useful for the step–by–step development of a DCC by the Handbook user. The duration of a dualized training program to be developed may run anywhere from six (6) months to three (3) years. The DCC that will be evolved using the identified Worksheets will include the knowledge and skills requirements of the dualized training program.

To offer the Handbook user a way of checking his/her work in progress, the following samples relative to PLANT MAINTENANCE MECHANIC are given at annexes.

Sample 1: **Time Model for a One–Year Program**

Sample 2: **Prototype DCC for PLANT MAINTENANCE MECHANIC (First Level) Part 1 – Knowledge Requirements**

Sample 3: **Prototype DCC for PLANT MAINTENANCE MECHANIC (First level) Part 2 – Skills Requirements**

Part C: Guidelines for Developing a Dualized Training Plan

This section provides direction on the step–by–step procedure in developing a dualized training plan (DTP) and provides discussion on the various considerations to be made in undertaking the process. The section starts off with a description of an open curriculum, the DTP being a document that is meant to offer a training scheme that follows the features of an open curriculum, then progresses on to offer useful inputs as regards the different considerations that have to be addressed in the development of a DTP.

FEATURES OF AN OPEN CURRICULUM

An open curriculum is distinguished by the following characteristics:

- Allows the selection and assignment by the curriculum developers of specific topics and projects for both the school/training center–based and company–based training;

- Learning environments or settings are adaptable to the conditions and presuppositions of training providers e.g. small–sized enterprises; and

- Teachers and Trainers may interpret learning objectives to suit the trainees' motivational state.

PROCEDURE IN DEVELOPING A DUALIZED TRAINING PLAN (DTP)

There are five (5) steps in developing a DTP. These are:

1. Elaborate the topics into suitable contents and the duties into attendant tasks;

2. Allocate appropriate duration of training time for each content and task;

3. Assign each content and task to appropriate training venue (school/training center classroom, workshop or company);

4. Formulate and arrange 'Training Plan objectives;

5. Recommend, for each content and task suitable training method, techniques, aids, materials, learning settings, etc. and indicate them as didactical remarks

The following section explains in some detail each of these steps as well as the various considerations that should be taken up in each step:

Step 1: **Elaborate the topics into suitable contents and the duties into attendant tasks**

The TESDA–approved Training Regulation (TR) for the occupation concerned is again a very valuable information resource for doing this step. This is because the TR already provides lists of Knowledge Requirements as well as lists of Skills Requirements of a particular occupation as part of its Occupational Skills Standards portion. This being the case, all that has to be done is to copy the entries or the knowledge requirements provided for in the TR as CONTENTS and the entries of the skills requirements provided for in the TR as TASKS. If necessary, additional contents and tasks may be added since the TR represents only the minimum standards, to which companies may have additional demands in terms of knowledge and skills requirements. For a greater appreciation of the implementation of this step, please refer to Form 4: Dualized Training Plan Skills Requirements (3 pages) and sample 4: Dualized Training Plan for Plant Maintenance Mechanic for Knowledge Requirements (14 pages).

If there is no available TR yet to serve as basis for the development of DTS/DT program, TESDA Order 154 should be used to identify the course's knowledge and skills requirements. Alternatively, the DACUM approach can be used to analyze the skills requirements and to update the Occupational Skills Standards of TESDA Order 154.

The tasks should not only be listed in the Training Plan but should be sequenced in a logical and systematic way – from easy to difficult, from simple to complex, and from general to specific.

The listed tasks should always be based on the results of job analysis. The needed tasks for a successful worker are the focus of training and learning processes.

Step 2: **Allocate appropriate duration of training time for each content and task**

This step is concerned with the allocation of appropriate training hours per content and task in the school/training center classroom and workshop or company. The following guide questions should be answered to determine the needed amount of time to be devoted for each content and task –

- How difficult is the content/task?
- How important is the content/task; and
- How complex is the content/task.

Obviously, the more difficult, important and complex the content/task is, the longer the time that it requires. It should be noted here, however, that the number of hours allotted particularly for each of the task is only suggestive at this stage. The final number of hours to be assigned for each task should be discussed and agreed upon with the representatives of cooperating companies.

After reviewing and refining part 2 of the Training Plan on the Skills Requirements, the Training Plan should be checked to see whether the total number of hours is within the general framework of the time fixed in the dualized core curriculum.

Step 3: **Assign each content and task to appropriate training venue (school/training center classroom, workshop or company);**

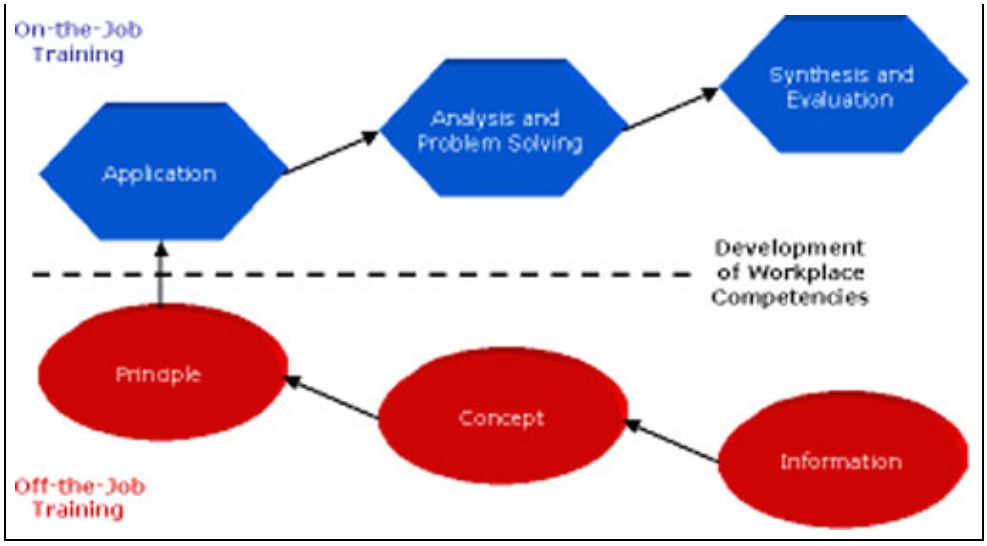
In most instances, the Knowledge Requirements should be presented as part 1 of the Training Plan. This is because managers of cooperating companies, during the negotiation stage, will be interested to know what knowledge and skills are already possessed by the trainees when they are admitted for in–plant training. This being the case, it becomes recommendable for most of the knowledge requirements to be offered during the in–school/training center phase of the course. Such knowledge inputs, particularly those that are trade–related should, nevertheless, be backed up by hands–on basic training at the school/training center's workshop. All these considerations should make the task of determining suitable time, content and task allocations for the various training venues (school/training center classroom and workshop or company) a lot easier.

Step 4: **Formulate and arrange DTP Objectives**

In performing this step, it is advisable to consider the following recommendations:

- The objectives should be formulated in such a way as to indicate the minimum level of performance standards expected and set for all student–trainees. In other words, objectives should be written according to workplace competencies (see Input Box C. 1);

Input Box C.1
Development of Objects According to Workplace Competencies



• DTP objectives should be able to inform, in advance, the trainers, teachers and student–trainees about the course's training units as well as the previously–set performance standards;

• While training objectives should be stated in specific terms, it should nonetheless take away from trainers and teachers the flexibility to interpret and situate these objectives to specific learning settings prevailing in different schools/training centers and companies;

• Objectives may be classified on the basis of the degree of their abstraction (Input Box C.2). For DTPs, the objectives should not be formulated in a very general way neither should they be stated in a very detailed way. The best way is to adopt the so–called 'rough' objectives since these objectives define, in clear terms, the knowledge and skills that the course intends to achieve;

Input Box C.2
Classifying Objectives

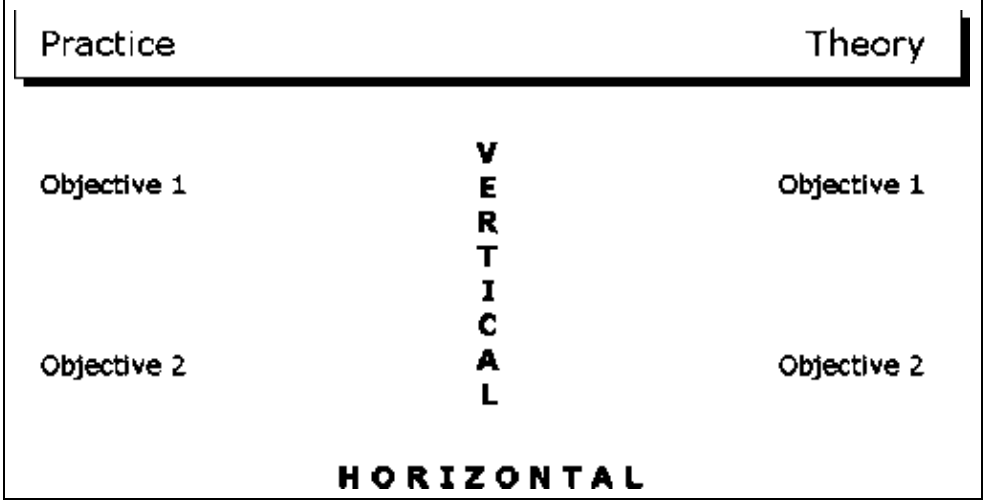
• **General Objectives** – constitute the highest level of abstraction and clarify intentions of educational policies and fundamental education goals. They are normally set out in educational platforms of ministries or other socially influential groups.

• **Rough Objectives** – of a middle abstraction level, they outline the knowledge and abilities that are to be achieved through a subject or a training course.

• **Individual/Detailed Objectives** – formulated with least level of abstraction, and therefore the greatest concreteness. They specifically state the knowledge, skills and attitudes that learners should acquire out of a particular teaching/training situation.

• It is recommended that special attention be given to the issue of horizontal and vertical coordination of training objectives (Input Box C.3). Vertical coordination is the process of sequencing teaching and training units from easy to difficult, and from general to specific. Horizontal coordination, on the other hand, is the process of coordinating teaching and training units between learning venues (school/training center and company). Adequate coordination of theoretical topics and content being taught at the school/training center and the practical skills and tasks being undertaken at the company is essential in dualized training plans.

Input Box C.3
Arrangement of Objectives



• As an example, a dualized training program for a machine fitter must provide the trainee with sufficient grounding in mathematics, physics and technical drawing at the school to adequately prepare him to use a milling machine in making a gear wheel.

• As a rule, training objectives should be preceded by the phrase, "The trainee should be able..." then followed by 'to' plus an action verb. For guidance, Input Box C.4 provides the taxonomy of verbs that can be used for writing objectives. These verbs have been classified according to the level of the learning targeted from low to high. The same input box shows vague words or non–behavioral verbs, which should be avoided in writing training objectives.

Input Box C.4
Taxonomy of Verbs in Writing Objectives

Category	**Action Words**			
Knowledge	Arrange Define Duplicate List State	Select Related Repeat Define Order	Measure Recognize Recall Reproduce	Write Label Memorize Name
Comprehension	Classify Explain Identify Tell Restate	Contract Discuss Illustration Locate	Explain Express Indicate Review	Describe Draw Translate
Application	Analyze Appraise Calculate Categorize	Criticize Compare Discriminate Experiment	Distinguish Diagram Examine	Inventory Question Test
Synthesis	Propose Organize Design Prepare	Construct Assemble Setup Collect	Derive Manage Create Summarize	Compose Combine Plan
Evaluation	Appraise Predict Defend Attack	Argue Support Rate Estimate	Judge Compare Assess	Determine Evaluate Value

Vague Words				
Accept Aware Remember Recall	Ascertain Consider Grasp Value	Familiarize Cope Realize Recognize	Appreciate Believe Imagine Comprehend	Know Understand Discern

• The complexity of the training objectives becomes the basis for organizing them in the training plan. The complexity aspect provides a basis for classifying objectives (Input Box C.4) according to hierarchical levels or taxonomies. The more complex objectives (application, synthesis, evaluation) are suppose to build upon those of the simpler levels (knowledge, understanding).

• The aspect of complexity (taxonomies) is also useful for devising and formulating examination requirements.

Input Box C.5
Examples of Knowledge–based "Competencies", Tasks (Training Content), and Objectives

The objective should read:

'The trainee should be able' – and followed by to' + verb

Task:	Task:
Interpret electrical, electronic, and mechanical blueprints	**Work with data**
Objectives:	Objectives:
1. To identify types of blueprints and their applications 2. To identify applications of auxiliary views, revolutions, and sectional views 3. To interpret mechanical/electrical/electronic production and assembly drawings	1. To locate needed data using manufacturer's data books 2. To analyze data from tables 3. To record data results 4. To prepare equipment–failure reports
Task:	Task:
Service motors and motor control circuits	**Apply established troubleshooting tips**
Objectives:	Objectives:
1. To follow safety procedures established for servicing motors and control units 2. To apply the National Electric Code and other electrical standards 3. To troubleshoot power distribution systems 4. To repair power distribution systems 5. To demonstrate knowledge of basic principles, operation and application of different servo control systems 6. To troubleshoot different types of servo control systems	1. To verify system operator 2. To assess signs and symptoms of malfunction 3. To determine problem areas by symptom 4. To analyze schematics/blueprints to determine system function 5. To diagnose problems by signal tracing or signal injection

	6. To isolate defective unit, circuit, and components 7. To verify operation following repair

• The objectives should be stated in a specific way. It should read: 'The trainee is able' – and followed by 'to' plus a verb (according to taxonomies, see Input Box C.5).

Part D: Recommendations for Curriculum Evaluation

The dualized training plans must be tested (on a regional basis) and revised when necessary. Those involved in Curriculum Evaluation must have a proper administrative mandate in order to ensure that evaluation results are recognized nationwide by all concerned parties.

The curriculum experts and decision makers must have adequate educational and technical expertise. Formative evaluation an DTS training plans should include:

• Questions to industry/company representatives. These questions refer to job demands, the cost of implementing dual training in the company, and adaptability of the curriculum in the workplace.

• Questions to teachers and instructors. These questions refer to concerns such as clear testimonies, difficulties encountered, retraining needs of teachers and instructors, additional didactic remarks, training hours and venues, as well as realistic learner abilities.

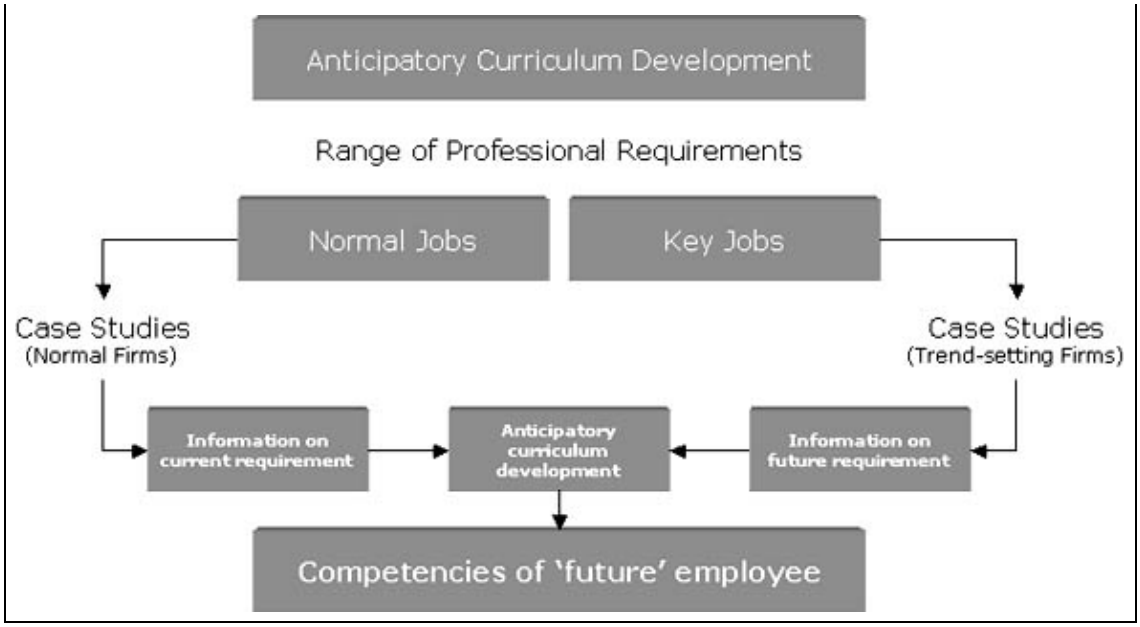
• Questions to students/learners. These questions refer to the degree of difficulty in implementing the new training plan, learning media and time schedule.

• Questions to curriculum experts. These questions should refer to verification of detailed levels of abstraction of objectives, vertical and horizontal coordination of learning process, harmony with other curricula, open features of dualized training plans, as well as competencies and generic skills.

If knowledge and skills requirements must be updated, the 'anticipatory' curriculum development and evaluation is recommended. Case studies of key jobs in trend setting firms (e.g. those involved in new technology, innovative and work organizations) provide information on future requirements on certain occupations, information on current and future knowledge and skill requirements lead to an anticipatory curriculum and future–oriented training plans. These plans identify and support the competencies and qualifications of future employees (See Input Box D.1).

Evaluation is done with the aim of ensuring that the trainees are adequately qualified and motivated for current and future activities in their respective occupations.

Input Box D.1
Evaluation and Curriculum Development



Abbreviations List

CBT	– Competency–Based Training
DACUM	– Developing a Curriculum
DTS	– Dual Training System
GTZ	– Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
NITVET	– National Institute of Technical Vocational Education and Training
OA	– Office of Apprenticeship
OSS	– Occupational Skills Standards
TAP	– Technical Advisory Panel
TEP	– Technical Experts Panel
TESDA	– Technical Education and Skills Development Authority
TR	– Training Regulations
H	– Hour
C	– Classroom
SS	– School Shop
IN	– Industry
NC	– National Certificate

Annexes

Annex A: Prototype Core Curriculum for Plant Maintenance Mechanic (First Level)

Part 1: Knowledge Requirements

PROTOTYPE CORE CURRICULUM

Sector	:	Metal and Engineering Occupations
Occupational Field	:	Plant Maintenance Mechanic
Level	:	First Level
Subject	:	
National Certificate	:	National Certificate II
Duration	:	1 Year (Part 1 and 2)
Duration Part 1	:	1 Semester = 18 weeks = 92 days (1 day In–School/Center = 6h, 1 day In–Firm = 8h)

COURSE CONTENT

Part 1. Based on Knowledge Requirements of the Training Regulation for Plant Maintenance Mechanic

Code: (TR)	Topics	Knowledge	Skills	
		Classroom	School–Shop	Industry
1.1	Safety Precautions	*to be imparted during the entire subject*		
1.2	Blueprint Reading and Drawing	5 days	–	–
1.3	Shop Mathematics	10 days	–	–
1.4	Measurements and Inspection	2 days	3 days	–
1.5	Materials and Heat Treatment	2 days	–	–
1.6	Tool room Machining	5 days	25 days	–
1.7	Hand– and Power–operated Tools	*to be imparted during the entire subject*		
1.8	Hydraulics and Pneumatics	3 days	5 days	–
1.9	Mechanism and Machine Elements	5 days	–	–
1.10	Machine Repair/Overhaul	–	7 days	–
1.11	Preventive and Corrective Maintenance		4 days	–
1.12	Machine Reconditioning	–	4 days	–
	Industry Immersion	–	–	12 days
	Summary	32 days	48 days	12 days
		80 days (480 hours)		12 days (96 hours)
	Total	92 days		

Part 2: Skills Requirements

PROTOTYPE CORE CURRICULUM

Sector	:	Metal and Engineering Occupations

Occupational Field	:	Plant Maintenance Mechanic
Level	:	First Level
Subject	:	
National Certificate	:	National Certificate II
Duration	:	1 Year (Part 1 and 2)
Duration Part 2	:	1 Semester + Semestral Break = 28 weeks = 168 days (1 day In−School/Center = 8h, 1 day In−Firm = 8h)

COURSE CONTENT

Part 2. Based on Skills Requirements of the Training Regulation for Plant Maintenance Mechanic

According to DACUM Research Chart

Code: (TR)	Duties	Knowledge	Skills	
		Classroom	School−Shop	Industry
A	Performing Preventive Maintenance	1 day	2 days	30 days
B	Performing Corrective Maintenance	–	2 days	30 days
C	Repairing and maintaining fluid system	1 day	3 days	30 days
D	Fabricating simple parts	1 day	5 days	40 days
E	Fitting parts into assembly	1 day	2 days	20 days
		4 days	14 days	150 days
	Summary	18 days (144 hours)		150 days (1200 hours)
	Total	260 days		
Part 1 (Knowledge Rqmts. & Ind. Immersion)		80 days		12 days
Part 2 (Skills Requirements)		18 days		150 days
Total Summary		98 days		162 days
		260 days		

Annex A: Prototype Dualized Training Plan for Plant Maintenance Mechanic (First Level)

Part 1: Knowledge Requirements

PROTOTYPE DUALIZED TRAINING PLAN

Drafted by Workgroup	:	
Sector	:	Metal and Engineering Occupations

Occupational Field : Plant Maintenance Mechanic

Level : Class B

Subject :

National Certificate : National Certificate II

Duration : 1 Year (Part 1 and 2)

Duration Part 1 : 1 Semester = 18 weeks = 92 days
(1 day In–School/Center = 6h, 1 day In–Firm = 8h)

COURSE CONTENT

Part 1. Based on Knowledge Requirements of Plant Maintenance Mechanic

Training Plan for Schools/Centers and for Industry Immersion

According to DACUM Research Chart

Knowledge Requirements		Objectives	Contents		Learning Hours			Didactical Remarks (Recommendations)
					C	SS	IN	
1.1	Safety Precautions	To interpret safety precautions and analyze the safety conditions of the working place			To be imparted during the entire subject			Regular meeting and exercises. Information material.
			1.1.1	Safe handling of tools, equipment and materials				Seminars and learning sessions.
			1.1.2	Protective clothing and equipment				
			1.1.3	Cleanliness and tidiness				
			1.1.4	First–aid Treatment				
			1.1.5	Fire extinguisher				
			1.1.6	Safety and health regulation				
1.2	Blueprint Reading and Drawing	To explain the information given in technical drawings and apply this information for different manufacturing processes. To translate the abstract in			30			

		formation into practice.						
			1.2.1	The working Drawing: requirements of an explicit working drawing, manufacturing specification to ensure correct processing	6			Lecture
			1.2.2	ISO Limits and Fits: general and shafts; commonly used holes and shafts; tolerances grades; commonly used fits; use of table	4			Tutorial
			1.2.3	The reference surface: datum featuring used measuring and setting–up	4			Practical Exercise
			1.2.4	Machining accuracy: dimension chain and classification; rules in dimensional relationship	4			
			1.2.5	Geometrical Tolerances: Conventional representation of geometric tolerances especially to straightness, flatness, parallelism and locational tolerances	4			
			1.2.6	Surface Finish: Definition of terms; conventional representation specification	4			
			1.2.7	Graphs: Use and interpretation; making graphs of different types, Cartesian, polar and logarithmic	4			
1.3	Shop Mathematics	To demonstrate basic mathematical			60			Self–learning programs Problem–solving teamwork

		operations and solve related workshop problems.						
			1.3.1	Average, percentage, ratio proportion	4			Evaluation and assessment instruments
			1.3.2	Manipulation of formulas, areas and plan figure, volumes and weight of common regular solids	12			Lecture
			1.3.3	Geometrical properties of a circle	4			
			1.3.4	Simple trigonometric functions and application	16			
			1.3.5	Pythagorean theorem	12			
			1.3.6	Workshop problem in layout, measuring, setting−up and machining	12			
1.4	Measurements and Inspection	To list measuring tools and distinguish the application in different operational areas.			12	18		Lecture Practical Exercises
			1.4.1	Tools of measuring: The reference gauge, the measuring tools and comparators.	4	6		Instructional materials
			1.4.1.1	Measuring Tools: Use, care and calibration of vernier calipers, micrometers dials, indicators, special measuring tools, special applications in measuring angles, tapers, center distances, bore, etc.	8	12		Evaluation assessment instruments
1.5	Materials and Heat Treatment	To classify the physical properties of			12			Lecture

		metals and distinguish heat treatment operations and procedures needed to fabricate simple parts.						
			1.5.1	Tool Components	4			Instructional materials
			1.5.1.1	Physical properties of tool components for cutting and shearing, drawing, hot pressing tool, extrusion tools dies sinking tools: – Low melting alloys – Cast iron, high grade – Carbon steel	2			Evaluation and assessment instruments Company visit
			1.5.2	Heat treatment operations	2			
			1.5.2.1	The procedure followed in: – Hardening – Tempering – Flame hardening	2			
			1.5.2.2	Heat treatment equipment and control	2			
1.6		To identify and explain parts and functions and operating procedures of various machine tool.			30	150		Lecture
			1.6.1	Materials Preparations: machines used for preparation of materials: power hacksaw, band saw, abrasive cutters, gas cutting	2	2		Practical exercises Instructional materials
			1.6.2	Marking and Layout: The manual method of location of holes and outlines	2	4		Evaluation and assessment materials
			1.6.3	Turning: The machine tools needed, work holding devices, tools and	8	42		Company visit Trainer and simulators

				attachment: – Safety precaution – Spindle speeds and feed rate for different materials & tools – Turning faults and correction				
			1.6.4	Milling: Machine tool used, work holding devices, tools and attachment used: – Safety precaution – Spindle speeds and feed rate for different materials and tools – Work holding devices – Milling computations	8	42		
			1.6.5	Grinding: – Safety precautions – Selection of grinding wheel – Grinding wheel specifications – Work holding devices – Grinding operations involving surface grinding	6	18		
			1.6.6	Benck work operations safety, tools, work holding devices for: – Filing – Scraping – Drilling/counter boring – Tapping	4	42		
1.7	Hand– and Power–operated Tools	To classify types of hand tools and explain their uses.			To be imparted during the entire subject			
			1.7.1	Types and uses of hand tools (wrenches, files, pliers, pullers, screw driver, punchers, hacksaws, and hammers)	18	30		Lecture Instructional materials Evaluation and assessment instruments Lecture
1.8	Hydraulics and Pneumatics	To identify symbols and controls used						

		in fluid system, and apply the basic fluid principles necessary to repair and maintain fluid system.						
			1.8.1	Knowledge of the symbols used in hydraulic and pneumatic diagrams	12	16		Instructional materials Practical exercises
			1.8.2	Types of control valves and application	2	6		Trainers/simulators Evaluation and control instruments
			1.8.3	Basic fluid principles	2	4		
			1.8.4	Uses of filters and strainers	2	4		
1.9	Mechanism and Machine Elements	To Identify common machine parts and their uses, and explain its installing procedures.			30			Lecture
			1.9.1	Identification of common machine parts	4			Instructional materials
			1.9.2	Kinds of bearings and their uses	8			Evaluation and assessment instruments
			1.9.3	Storage, cleaning and lubrication of bearings	4			
			1.9.4	Identification of different kinds of scales, packing and gaskets	4			
			1.9.5	Procedure in installing of belts, couplings and bearings	8			
			1.9.6	Relation of machine parts with others	2			
1.10	Machine Repair/Overhaul	To identify machine parts and functions and explain dismantling and assembling procedures.				42		Lecture

		To diagnose common machine faults	1.10.1	F unction of machine element		4		Instructional materials Trainers/simulators
			1.10.2	F unction of machine parts		4		Practical exercises
			1.10.3	Steps and procedures in dismantling and assembling of standard parts		4		Evaluation and assessment instruments
			1.10.4	Common machine faults		6		
			1.10.5	Electric arc and gas welding		24		
1.11	Preventive and Corrective Maintenance	To identify machine parts that requires lubrication and explain lubrication procedures and scheduling.			24			Lecture
			1.11.1	Lubricating procedures for machines like shaper, drilling, lathe, milling, boring and grinding machine	12			Instructional materials Practical exercises
			1.11.2	Frequency for changing of oil of shop equipment/machine tools	6			Evaluation and assessment instruments
			1.11.3	Identification of machine parts requiring lubrication	6			Company visit
1.12	Machine Reconditioning	To determine steps and procedures in setting–up parts, in accordance with machine metrology.				24		Lecture
			1.12.2	Machine tool metrology		12		Instructional materials
			1.12.3	Knowledge of transporting equipment		4		Practical exercises
			1.12.4	Steps and procedures in		8		Evaluation and assessment

				setting−up parts				instruments
2.1	Industry Immersion	To join in selected firms for familiarization and job induction of possible company assignment					96	
			Summary		192	288	96	
					480		96	
			Total		576h			

Part 2: Skills Requirements

PROTOTYPE DUALIZED TRAINING PLAN

Drafted by Workgroup	:	
Sector	:	Metal and Engineering Occupations
Occupational Field	:	Plant Maintenance Mechanic
Level	:	Class B
Subject	:	
National Certificate	:	National Certificate II
Duration	:	1 Year (Part 1 and 2)
Duration Part 2	:	1 Semester + Semestral Break = 28 weeks = 168 days (1 day In−School/Center = 8h, 1 day In−Firm = 8h)

COURSE CONTENT

Part 2. Based on Skills Requirements of Plant Maintenance Mechanic

Training Plan for Schools/Centers and for Industry

Skills Requirements		Objectives		Contents	Learning Hours			Didactical Remarks (Recommendations)
					C	SS	IN	
A	Perform Preventive Maintenance	To inspect and maintain various machines/equipment in accordance with manufacturers specifications and preventive maintenance scheduling.			18	16	240	Lecture Instructional materials
			A −2	Lubricate machines		20	24	Practical exercises
					2	2	40	

			A –3	Inspect/maintain V–belt drive				Competency assessment instruments
			A –4	Inspect/maintain chain and sprocket drives	2	2	40	Industry immersion
			A –8	Adjust gibs of slide ways		2	16	Company visit
			A –9	Inspect/maintain drive coupling	2	2	40	
			A –13	Lubricate seal faces		2	16	
			A –14	Participate in safety training program		2	24	
			A –15	Orient OJT trainees/operators on safety and maintenance practices	2		24	
			A –16	Perform housekeeping		2	16	
B	Perform Corrective Maintenance	To remove and install specific spare parts in accordance with manufacturers specifications and machine setting and tolerances.				16	240	
			B –2 (A)	Remove and install plain bearing (bushes and sleeves)		8	120	
			B –4 (A)	Remove and install roller bearing		8	120	
C	Repair and maintain fluid system	To describe the functions of hydraulic systems.			8	24	240	
		To inspect and replace hydraulic lines and piping systems.	C –1 (A)	Inspect a hydraulic system	8	8	80	
			C –9	Replace hydraulic gasket and seals		2	8	
			C –11	Repair/replace hydraulic lines		4	80	
			C –12	Replace damaged/faulty lines/fittings		4	24	

			C –16	Install and replace a steel piping system		4	40	
			C –20	Install plastic tube to machine		2	8	
E	Fabricate simple parts	To demonstrate skills on operating various industrial tools and machine/equipment.			8	40	320	
			E –1	Cut metal stock with hand hacksaw			4	
			E –2	Cut metal stock with hand chisel			4	
			E –3	File workpiece			16	
			E –4	Mark workpiece		2	4	
			E –5	Drill holes with portable drill		2	4	
			E –6	Drill holes to size with drill press		2	8	
			E –7	Counterbore holes to depth		2	8	
			E –8	Countersink holes		2	4	
			E –9	Spot–face hole		2	4	
			E –12	Cut internal thread with hand taps		2	8	
			E –13	Cut thread with dies		2	8	
			E –21 (A)	Gas weld ferrous metals	2	4	40	
			E –25	Arc–weld ferrous metals	2	4	40	
			E –27	Harden metals	2	4	8	
			E –28	Temper metals	2	2	4	
			E –29	Turn workpiece		4	40	
			E –30	Face workpiece		2	40	
			E –32	Mill workpiece square		4	80	

			(A)					
F	Fit parts into assembly	To fit and assemble parts with specified connectors in accordance with manufacturers specifications and mechanical safety.			8	16	160	
			F –2	Bolt parts		2	16	
			F –3	Dowel parts		2	16	
			F –4	Pin parts to a schaft		2	16	
			F –6	Fit/extract wheel	2	2	24	
			F –7	Fit parallel and tapered keys	2	2	16	
			F –8	Fit/extract bearing	2	4	40	
			F –13	Bend pipes	2	2	32	
			Summary		32	112	1200	
					144		1200	
			Total		1344h			

Note: Didactical remarks are recommended for all competencies

Annex B: Training Regulations for Plant Maintenance Mechanic

Occupational Skills Standards

Introduction

This Occupational Skills Standard defines the MINIMUM required stock of knowledge and skills a tradesman is supposed to possess to qualify as a PLANT MAINTENANCE MECHANIC. A tradesman is granted a certificate of proficiency (national skills certificate) under this occupational title once he passes the Competency Assessment.

This Occupational Skills Standard is herein formulated and developed for any, and/or all of the following purposes:

1. To upgrade the level of skill of workers in the METALS and ENGINEERING INDUSTRY, with the end in view of coming up with quality products/service, optimal use of equipment/tools/materials and increased productivity.

2. To provide employers with a structural basis in the preparation of job specification necessary for salary and/or wage administration.

3. To enhance the development of human resources through a precise assessment of skilled manpower in the Metals and Engineering Industry at large.

4. To serve as a basis in the establishment of Testing and Certification System, which machinery can be used for setting up of a classified pool of Plant Maintenance Mechanics ready to service both domestic and overseas requirements.

5. To facilitate the setting up of machinery for determination of appropriate and adequate remuneration and the implementation of "equal work, equal pay".

6. Finally, to enhance the government's desire to professionalize the skilled worker for which role the Technical Education and Skills Development Authority was established.

General Principles

1. Classification

1.1 This Trade Skills Standard classifies PLANT MAINTENANCE MECHANIC into two (2) classes: Class B and Class A (the higher).

1.2 Candidates who wish to be certified for their competency as PLANT MAINTENANCE MECHANIC will be required to show by written examination and by practical demonstration that they are in possession of the knowledge and skills required by the standard.

1.3 Candidates who passed the trade test will be issued a certificate bearing their names and photograph and shall be listed in the National Registry of Certified Skilled Workers in the Philippines.

2. Entry Requirements

2.1 Candidates for certification as PLANT MAINTENANCE MECHANIC class B must:

2.1.1 Have had one year work experience as Plant Maintenance Mechanic; or

2.1.2 Have completed a short intensive training in Plant Maintenance Mechanic conducted by Technical Education and Skills Development Authority (TESDA), or any certified industrial/training institution; or equivalent course requiring a minimum of 720 hours of practical training recognized by TESDA followed by one (1) year working experience as a Plant Maintenance Mechanic, or

2.1.3 Have completed a primary apprenticeship training approved by the Department of Labor and Employment, or a appropriate training which equates to a short intensive course as Plant Maintenance Mechanic.

2.1.4 Candidate for certification for Plant Maintenance Mechanic Class A must:

2.1.5 Have had one year relevant working experience as Plant Maintenance Mechanic Class B or,

2.1.6 Have completed an intensive advanced training course in Plant Maintenance Mechanic conducted by TESDA or any certified industrial/training institution, or

2.1.7 Have at least four (4) years working experience as Plant Maintenance Mechanic.

3. Definition of Terms

For the purpose of this standard, the word

3.1 Class refers to the category according to the level of difficulty and complexity of skills and knowledge required of the job.

4. Delimitation of this Standard

In the context of this prepared standard, Plant Maintenance Mechanic's body of knowledge and skills covers only machine maintenance and does NOT include:

4.1 machine tool rebuilding
4.2 production tooling

Job Description

PLANT MAINTENANCE MECHANIC

A Plant Maintenance Mechanic performs preventive and corrective maintenance, repairs and maintains fluid systems, install and removes machinery, and fabricates and fits machinery parts.

CLASSIFICATION

In this Occupational Skills Standard, Plant Maintenance Mechanics are classified according to level of difficulty and complexity of skills and knowledge required of the job and consideration on safety.

A PLANT MAINTENANCE MECHANIC CLASS B is equivalent to a skilled worker who has the ability to do a practical job or work at high level of efficiency and manipulative skills.

A PLANT MAINTENANCE MECHANIC CLASS A is equivalent to a highly – skilled worker who has the ability to perform a wide range of tasks at high level competence.

PLANT MAINTENANCE MECHANIC CLASS B

A Plant Maintenance Mechanic Class B performs preventive maintenance, repairs and maintains fluid system, and fabricates and fits parts into assembly.

In particular, under limited supervision of a Class A mechanic, he:

1. Lubricate and adjusts machines, belts and drives, chain and sprockets drives, gobs, couplings and seals and participates in training and orients trainees and performs housekeeping;

2. Replaces gaskets and seals, hydraulic lines and fittings and steel piping system and installs plastic tubes to machines;

3. Performs cutting with hacksaw, cutting with cold chisel, filling and marking of workpieces;

4. Drills, counterbores, countersinks and spot – faces holes and performs threading using taps and dies;

5. Welds, hardens and tempers metals and operates lathe to turn and face workpieces;

6. Bolts, pins and dowels parts and fits wheels, keys and bearings and bends pipes.

PLANT MAINTENANCE MECHANIC CLASS A

A Plant maintenance Mechanic Class A performs preventive maintenance, repairs and maintains fluid systems, installs and removes machineries, and fabricates and fits parts into assembly.

In addition to performing work of the Plant maintenance Mechanic Class B, he:

1. Maintains linkages and mechanism, bearing, gear drives, centrifugal and pneumatic clutch and gear box drives;

2. Diagnose machine breakdown and remove and installs plain bearing bushes and sleeves and roller bearings;

3. Removes and installs belts, chain drives, flexible couplings and universal joints;

4. Maintains hydraulic strainers/filters, cylinders, motors or pumps, and repairs/replaces;

5. Repairs/replaces internal parts of vane–and piston –type hydraulic pump or motor;

6. Repairs/replaces hydraulic gaskets and seals, flexible hoses. Lines, fittings and valves;

7. Install and maintains air–compressor and water pump;

8. Transport, moves, installs, positions and aligns machineries;

9. Reams holes and laps flat surfaces and aligns machineries;

10. Cuts, shapes, welds and solders metal using gas cutting equipment; and

11. Aligns parts, scrapes workpieces, fits flanges and balances static rotating parts.

Index of Knowledge Requirements

Code	Knowledge Requirements	Class B	Class A
1.1	**SAFETY PRECAUTIONS**		
1.1.1	Safe handling of tools, equipment and materials	X	
1.1.2	Protective clothing and equipment	X	
1.1.3	Cleanliness and tidiness	X	
1.1.4	First–aid treatment	X	
1.1.5	Fire extinguishers	X	
1.1.6	Safety ad health regulation	X	
1.2	**BLUEPRINT READING AND DRAWING**		
1.2.1	The Working Drawing: requirement of an explicit working, drawing, manufacturing, specifications to ensure correct processing	X	

1.2.2	ISO Limits and Fits: general and shafts, commonly used holes and shafts; tolerances grades; commonly used fits, use of tables	X	
1.2.3	The reference surface: datum featuring used measuring and sitting up	X	
1.2.4	Machining accuracy: dimension chain and classification; rules in dimensional relationship	X	
1.2.5	Geometrical Tolerances: Conventional representation of geometric tolerances especially to straightness, fitness, parallelism and locational tolerances	X	
1.2.6	Surface Finish: Definition of terms; conventional representation specification	X	
1.2.7	Graphs: Use and interpretation; making graphs of different types, cartesian, polar, and logarithmic	X	
1.3	**SHOP MATHEMATICS**		
1.3.1	Average, percentage, ratio and proportion	X	
1.3.2	Manipulation of formulas Areas and plan figure, volume and weight of common regular solids	X	
1.3.3	Geometrical properties of a circle	X	
1.3.4	Simple trigonometric functions and application	X	
1.3.5	Pythagorean theorem	X	
1.3.6	Workshop problem in layout, measuring, setting up and machining	X	
1.4	**MEASUREMENTS AND INSPECTION**		
1.4.1	Standard of length; international metric standard; the flow chart showing interrelation form primary workshop measuring instrument; dimensional stability in the workshop, the " ten percent rule " calibration of measuring tools.		X
1.4.2	Tools of Measuring: The reference gauge, the measuring tools, and comparators	X	
1.5	**MATERIALS & HEAT TREATMENT**		
1.5.1	Tool Components		
1.5.1.1	Physical properties of tool components for cutting and searing, drawing, hot pressing tool, extrusion tools, dies sinking tools:		
	– Low melting alloys	X	
	– Cast iron, high grade	X	
	– Carbon steel	X	
	– Tool steel and alloyed steel		X
	– Rubber, polyurethane		X
	– Carbides		X
	– Composites		X
1.5.2	Heat treatment operations		
1.5.2.1	The procedure followed in:		
	– Annealizing		X
	– Normalizing		X
	– Hardening	X	

	– Tempering	X	
	– Flame hardening	X	
1.5.2.2	Heat treatment equipment and control	X	
1.5.2.3	Inspection of heat treated parts		
	– Crack detection		X
	– Warpage test		X
	– Hardness test		X
1.6	**TOOLROOM MACHINING**		
1.6.1	*Materials Preparations:* machine used for preparation of materials: power hacksaw, bandsaw, abrasive cutters, gas cutting	X	X
1.6.2	*Marking and Layout:*		
1.6.2.1	The manual method of location of holes and outlines	X	
1.6.2.2	The use of jigs borers		X
1.6.3	*Turning:* The machine tools needed, work holding devices, tools and attachment used		
1.6.3.1	Safety precaution	X	
1.6.3.2	Spindle speed and feed rate for different materials and tools	X	
1.6.4	*Milling:* Machine tool used, work holding devices, tools and attachment used		
1.6.4.1	Safety precaution	X	
1.6.4.2	Spindle speed and feed rate for different materials and tools	X	
1.6.4.3	Work holding devices	X	
1.6.4.4	Milling faults and ratifications		X
1.6.4.5	Milling computations	X	
1.6.4.6	Advanced milling problems		X
1.6.5	*Grinding:*		
1.6.5.1	Safety precaution	X	
1.6.5.2	Selection of grinding wheel	X	
1.6.5.3	grinding wheel specifications	X	
1.6.5.4	Balancing & mounting of grinding wheel		X
1.6.5.5	Dressing a grinding wheel		X
1.6.5.6	Wheek speed, work speed, and feed rate		X
1.6.5.7	Work holding devices	X	
1.6.5.8	Grinding operations involving		
	– Surface grinding		X

	– Cylindrical and taper		X
	– Internal grinding		X
	– Linear form grinding		X
1.6.6	Machining surfaces of irregular shapes		X
1.6.7	Bench work operations safety, tools, work holding devices for:		
	– Filing	X	
	– Scraping	X	
	– Drilling/counter boring	X	
	– Reaming		X
	– Tapping	X	
	– Polishing		X
1.7	**HAND AND POWER OPERATED TOOLS**		
1.7.1	Types and uses of handballs (wrenches, files, pliers, pullers, screw drivers, punchers, hacksaws and hammers)	X	
1.7.2	Types and uses of power tools (grinders, sanders, polishers, electric drills and hydraulic pullers)		X
1.8	**HYDRAULICS AND PNEUMATICS**		
1.8.1	Knowledge of the symbols used in hydraulic and pneumatic diagram	X	
1.8.2	Types of control valves and application	X	
1.8.3	Basic fluid principles	X	
1.8.4	Hydraulic and pneumatic pipings		X
1.8.5	Uses of filters and strainers	X	
1.8.6	Types of pumps and uses		X
1.8.7	Liquid use in hydraulic system		X
1.8.8	Hydrostatic testing		X
1.9	**MECHANISM AND MACHINE ELEMENTS**		
1.9.1	Identification of common machine parts	X	
1.9.2	Kinds of bearing and their uses	X	
1.9.3	Storage, cleaning and lubrication of bearings	X	
1.9.4	Identification of different kinds of seals, packing and gaskets	X	
1.9.5	Procedure in installing of belts, couplings and bearings	X	
1.9.6	Clearance/timing of gears		X
1.9.7	Relation of machine parts and others	X	
1.9.8	Cams and their uses		X
1.10	**MACHINE REPAIR AND OVERHAUL**		
1.10.1	Function of machine elements	X	

1.10.2	Function of machine parts	X	
1.10.3	Steps and procedures in dismantling and assembling of		
	– standard parts	X	
	– major parts/components of machine		X
1.10.4	Common machine faults	X	
1.10.5	Special tools/fixtures for dismantling/assembling		X
1.10.6	Fits and tolerances		X
1.10.7	Electric arc and gas welding	X	
1.11	**PREVENTIVE AND CORRECTIVE MAINTENANCE**		
1.11.1	Lubricating procedures for machines like shaper, drilling, lathe, milling, boring and grinding machine	X	
1.11.2	Frequency for changing of oils of shop equipment/machine tools	X	
1.11.3	Identification of machine parts requiring lubrication	X	
1.11.4	Knowledge of checking out machine for major repair		X
1.12	**MACHINE RECONDITIONING**		
1.12.1	Knowledge of machine tool standard		X
1.12.2	Machine metrology	X	
1.12.3	Knowledge of transporting equipment	X	
1.12.4	Sequence of reconditioning operation		X
1.12.5	Steps and procedures in setting–up parts	X	
1.12.6	Type and uses of rust preventive and paints		X

Index of Skills Requirements

Code	Skills Requirements	Class B	Class A
2.1	**PERFORMING PREVENTIVE MAINTENANCE**		
2.1.1	Performing PM inspection		X
2.1.2	Lubricating machines	X	
2.1.3	Maintaining belts and V–belt drives	X	
2.1.4	Maintaining chain and sprocket drives	X	
2.1.5	Inspecting and maintaining linkages and mechanism		X
2.1.6	Maintaining bearings		X
2.1.7	Maintaining gear drives		X

2.1.8	Adjusting gibs for free operations	X	
2.1.9	Maintaining couplings	X	
2.1.10	Inspecting/maintaining centrifugal clutch		X
2.1.11	Inspecting/maintaining pneumatic clutch		X
2.1.12	Inspecting/maintaining gear box drives	X	
2.1.13	Lubricating seal faces	X	
2.1.14	Participating in safety training program	X	
2.1.15	Orienting OJT trainees/operators on safety and maintenance	X	
2.1.16	Performing housekeeping	X	
2.2	**PERFORMING CORRECTIVE MAINTENANCE**		
2.2.1	Diagnosing machine breakdown		X
2.2.2	Removing and installing plain bearing (bushes and sleeves)		X
2.2.3	Removing and installing plain bearing on shafts		X
2.2.4	Removing and installing roller bearings		X
2.2.5	Straightening shaft using a press		X
2.2.6	Replacing a shaft		X
2.2.7	Removing and installing V−belt assembly		X
2.2.8	Constructing belt joints with mechanical fastener		X
2.2.9	Constructing belt joints with adhesive		X
2.2.10	Removing and installing chain drives		X
2.2.11	Installing and aligning flexible coupling		X
2.2.12	Replacing universal joints		X
2.2.13	Installing and aligning closed gear drive		X
2.2.14	Removing and installing lip seal		X
2.2.15	Removing and installing mechanical seals		X
2.2.16	Ordering materials for the job		X
2.2.17	Updating machine maintenance record		X
2.3	**REPAIRING AND MAINTAINING FLUID SYSTEM**		
2.3.1	Inspecting a hydraulic system		X
2.3.2	Replacing and clean hydraulic strainer/filter		X
2.3.3	Refilling hydraulic system		X
2.3.4	Inspecting hydraulic cylinder		X
2.3.5	Replacing hydraulic motor or pump		X
2.3.6	Replacing internal parts of hydraulic pump (vane type)		X
2.3.7	Replacing internal parts of hydraulic pump (piston type)		X
2.3.8	Replacing internal parts of hydraulic motor (vane type)		

2.3.9	Replacing hydraulic gasket and seals	X	
2.3.10	Repairing flexible hose (high pressure)		X
2.3.11	Repairing/replace hydraulic lines		X
2.3.12	Replacing damaged/faulty lines/fitting		X
2.3.13	Replacing valves in a hydraulic system		X
2.3.14	Inspecting pressure control relief valve (relief, reducing, sequencing)		
2.3.15	Inspecting directional valve		X
2.3.16	Installing and replace a steel piping system	X	
2.3.17	Installing air compressor		X
2.3.18	Lubricating air compressor		X
2.3.19	Inspecting/maintain air compressor		X
2.3.20	Installing plastic tube		X
2.3.21	Inspecting/maintaining water pump	X	
2.4	**INSTALLING AND MOVING MACHINERY**		
2.4.1	Preparing area for machine installation		X
2.4.2	Raising machinery using jacks, bars and blocks		X
2.4.3	Transporting machinery using forklift		X
2.4.4	Transporting machinery using overhead crane or chain block		X
2.4.5	Moving machine/equipment using roller		X
2.4.6	Moving machine/equipment with skids or dollies		X
2.4.7	Positioning and secure machinery on foundation		X
2.4.8	Leveling machinery on foundation		X
2.4.9	Aligning shaft (reverse indicator method)		X
2.4.10	Performing alignment test		X
2.4.11	Connecting machine to air or hydraulic source		X
2.4.12	Blocking and bracing equipment for moving or shipping		X
2.4.13	Cribbing a piece of equipment to distribute the load over a large area		X
2.5	**FABRICATING SIMPLE PARTS**		
2.5.1	Cutting metal stock with hacksaw	X	
2.5.2	Cutting metal stock with chisel		X
2.5.3	Filing workpiece	X	
2.5.4	Marking workpiece	X	
2.5.5	Drilling holes with portable tools	X	
2.5.6	Drilling holes to size with drill press	X	
2.5.7	Counter boring holes to depth	X	
2.5.8	Counter sinking holes	X	

2.5.9	Spot–facing hole		X
2.5.10	Reaming holes with hand reamer		X
2.5.11	Reaming hole using machine reamer		X
2.5.12	Cutting thread with hand taps	X	
2.5.13	Cutting thread with dies	X	
2.5.14	Removing damaged thread screws etc.		
2.5.15	Lapping flat surfaces		X
2.5.16	Lapping holes	X	
2.5.17	Installing gas regulator		X
2.5.18	Flame cutting metal with gas equipment	X	
2.5.19	De–burring with hand grinder	X	
2.5.20	Shaping (form) metals using heat	X	
2.5.21	Gas welding ferrous metals		X
2.5.22	Lead soldering metal		X
2.5.23	Off–hand grinding workpiece		X
2.5.24	Cutting off materials with disc cutter		X
2.5.25	Arc–welding ferrous metal	X	
2.5.26	Annealing metals		X
2.5.27	Hardening metals	X	
2.5.28	Tempering metals	X	
2.5.29	Turning workpiece	X	
2.5.30	Facing workpiece	X	
2.5.31	Grinding flat surfaces on surface grinder		X
2.5.32	Milling workpiece square	X	
2.6	**FITTING PARTS INTO ASSEMBLY**		
2.6.1	Fitting parts into assembly		X
2.6.2	Bolting parts	X	
2.6.3	Doweling parts	X	
2.6.4	Pinning parts to a shaft	X	
2.6.5	Locating parts by pegging		X
2.6.6	Fitting/extract wheel	X	
2.6.7	Fitting parallel and tapered keys	X	
2.6.8	Fitting/extract bearing	X	
2.6.9	Aligning parts		X
2.6.10	Scraping a small flat surface		X
2.6.11	Hand scraping bearing (round) surface		X

2.6.12	Balancing static rotating parts		X
2.6.13	Bending pipes	X	
2.6.14	Fitting pipe flange		X

DACUM Research Chart for Plant Maintenance Mechanic

Duties _____ Tasks _____

A. Perform Preventive Maintenance	Perform PM inspection		Lubricate machines		Maintain belt V–belt drive		Maintain chain and sprocket drives		Inspect, maintain linkage and mechanism		Maintain bearings		Maintain gear drives		Adjust gib for free operations	
	A–1	A	A–2	B	A–3	B	A–4	B	A–5	A	A–6	A	A–7	A	A–8	B
	Maintain couplings		Inspect/maintain centrifugal clutch		Inspect/maintain pneumatic clutch		Inspect/maintain gear box drive		Lubricate seal faces		Participate in safety training program		Orient OJT trainees/operator on safety and maintenance		Perform housekeeping	
	A –9	B	A –10	A	A –11	A	A –12	A	A –13	B	A –14. B	B	A –15	B	A –16	B
B. Perform Corrective Maintenance	Diagnose machine breakdown		Remove and install plain bearing (bushes and sleeves) B		Remove and install plain bearing on shafts		Remove and install roller bearing B		Straighten a shaft using a press		Replace a shaft		Remove and install a V–belt assembly		Construct belt joints with mechanical fasteners	
	B–1	A	B–2	A	B–3	A	B–4	A	B–5	A	B–6	A	B–7	A	B–8	A
	Construct belt joints with adhesives		Remove and install chain drive		Install and align flexible couplings		Replace universal joint		Install and align closed gear drive		Remove and replace lip seal		Remove and install mechanical seals		Order materials needed for the job	
	B–9	A	B–10	A	B–11	A	B–12	A	B–13	A	B–14	A	B–15	A	B–16	A
	Update machine maintenance record															
	B–17	A														
C. Repair and maintain fluid system	Inspect a hydraulic system B		Replace and clean hydraulic strainer/filter		Refill hydraulic system		Inspect hydraulic cylinder		Replace hydraulic motor or pump		Replace internal parts of hydraulic pump (vane type)		Replace internal parts of hydraulic pump (piston type)		Replace internal parts of hydraulic motor (vane type)	

	C–1	A	C–2	A	C–3	A	C–4	A	C–5	A	C–6	A	C–7	A	C–8	A		
	Replace hydraulic gasket and seals		Repair flexible hose (high pressure)		Repair/replace hydraulic lines		Replaced damaged/faulty lines/fittings		Replace valves in a hydraulic system		Inspect pressure control valve (relief, reducing, sequencing)		Inspect directional valve		Install and replace a steel piping system			
	C–9.A	B	C–10.A	A	C–11.A	B	C–12.A	B	C–13.A	A	C–14	A	C–15	A	C–16	B		
	Install air compressor		Lubricate air compressor		Inspect/maintain air compressor		Install plastic tube to machine		Disassemble and assemble a water circulating pump									
	C–17	A	C–18	A	C–19	A	C–20	B	C–21	A								
D. Install and Remove Machinery	Prepare area for machine installation		Raise machinery using jacks, bars and blocks		Transport machinery using fork lift		Transport machinery using overhead crane or chain block		Move machine/equipment using roller		Move machine/equipment with skids or dollies		Position and secure machinery on foundation		Level machinery on foundation			
	D–1	A	D–2	A	D–3	A	D–4	A	D–5	A	D–6	A	D–7	A	D–8	A		
	Align shaft (reverse indicator method)		Perform alignment test		Connect machine to air or hydraulic source		Block and brace equipment for moving or shipping		Crib a piece of equipment to distribute the load over a larger area									
	D–9	A	D–10	A	D–11	A	D–12	A	D–13	A								
E. Fabricate simple parts	Cut metal stock with hand hacksaw		Cut metal stock with chisel		File workpiece		Mark workpiece		Drill holes with portable tools		Drill holes to size with drill press		Counter bore holes to depth		Countersink holes			
	E–1.B	B	E–2.A	B	E–3.A	B	E–4.A	B	E–5.A	B	E–6.A	B	E–7.A	B	E–8.B	B		
	Spot–face hole		Ream holes with hand reamer		Ream hole using machine reamer		Cut thread with hand taps		Cut thread with dies		Remove damaged screws etc.		Lap flat surfaces		Lap holes			
	E–9.A	B	E–10	A	E–11	A	E–12	B	E–13	B	E–14	A	E–15	A	E–16	A		
	Install gas regulator		Flame cut metal with gas equipment		De–burr with hand grinder		Shape (form) metals using heat		Gas weld ferrous metals B		Lead solder metal		Off –hand grind workpiece		Cut off materials with disc cutter			
	E–17	A	E–18	A	E–19	A	E–20	A	E–21	A	E–22	A	E–23	A	E–24	A		
	Arc–weld ferrous		Anneal metals		Harden metals		Temper metals		Turn work piece		Face workpiece		Grind flat surfaces		Mill workpiece			

	Metals											on surface grinder		square		
	E–25	B	E–26	A	E–27	B	E–28	B	E–29	B	E–30	B	E–31	A	E–32	A
F. Fit parts into assembly	Fit parts into assembly		Bolt parts		Dowel parts		Pin parts to a shaft		Locate parts by pegging		Fit/extract wheel		Fit parallel and tapered keys		Fit/extract bearing	
	F–1	A	F–2	B	F–3	B	F–4	B	F–5	A	F–6	B	F–7	B	F–8	B
	Align parts		Scrape a small flat surface		Hand scrape bearing (round) surfaces		Balance static rotating parts		Bend pipes		Fit pipe flanges					
	F–9	A	F–10	A	F–11	A	F–12	A	F–13	B	F–14	A				

Task Analysis Sheets

Occupation Title: Plant Maintenance Mechanic

Task Analysis Sheet No. ___

Duty No. A	PERFORM PREVENTIVE MAINTENANCE		
Task No. 3	Inspect/Maintain V–belt drive		
Level ___	PERFORMANCE OBJECTIVES: Given malfunctioning belt drive, spare parts, supplies, tools and equipment, the student(s)/trainee(s) must be able to maintain a V–belt drive. The drive must deliver rated power smoothly and at rated speed.		
STEPS	**PERFORMANCE CRITERIA**	**RELATED KNOWLEDGE, ATTITUDE AND SAFETY**	**TOOLS, EQUIPMENT, AND MATERIALS**
Run mechanism at normal rate and load. Check for flying dirt, oil, grease, water and other debris. Check for flapping, oscillating, and slipping of belts. Check for squealing, binding and rubbing of parts. Turn off mechanism power. Remove belt guard. Check belts and pulley for uneven wear and	The drive must deliver rated power smoothly and at rated speed and free of uneven wear, squealing, high temperatures, flapping, flying dirt, rubbing of guard, and unscheduled shut down.	Explain the principle of operation of V–belts Enumerate the maintenance practices in the use of V–belts Enumerate the conditions of V–belt malfunction, symptoms, and causes of failure Follow the standard procedure in removing and installing V–belts Exercise extreme care in the inspection of V–belts at running condition.	Feeler bar Level set Mechanic's tool box (Hand tool) Personal safety equipment Set of V–belts sheave groove templates Straightedge or wire Switch lock out Tension meter

damage, and replace if necessary. Check for loose mounting bolts and loose guards. Check for hot belt, bearing and pulley. Check pulley alignment. Check belt tension. Clean, inspect drive for wear and damage. Install belt guard. Start mechanism and test. Note findings in preventive maintenance inspection report. Make necessary recommendation.			Thermometer (Fahrenheit) Tachometer

Occupation Title: Plant Maintenance Mechanic

Task Analysis Sheet No. ___

Duty No. A	PERFORM PREVENTIVE MAINTENANCE		
Task No. 4	Inspect/Maintain chain and sprocket drives		
Level ___	PERFORMANCE OBJECTIVES: Given the necessary tools, materials and equipment, the student(s)/trainee(s) must be able to maintain chain and sprocket drive. Chains and sprockets must operate within manufacturer's specifications.		
STEPS	**PERFORMANCE CRITERIA**	**RELATED KNOWLEDGE, ATTITUDE AND SAFETY**	**TOOLS, EQUIPMENT, AND MATERIALS**
Run mechanism at normal rate and load; Check for: Hot bearing, sprockets, and chain. Flying dirt, oil, grease, water and other debris. Loose, flapping, chain. Rubbing, squealing, binding parts and loose bolts.	Chain and sprocket drive must deliver rated power at rated speed smoothly, be free of uneven wear, squealing, high temperature, loose bolts, flapping chain, flying dirt, steam, oil, water and other chemicals, rubbing, binding, and unscheduled shut down.	Explain the principle of operation of chain drives, and its specifications Enumerate the operating symptoms of malfunctions of chain drives and causes of failure Enumerate the standard practices in the maintenance of chain drives Follow the standard procedure in handling,	Chain detacher (s) Coupling tools Drive pins Fahrenheit thermometer Feeler bars Level set Manufacturers specifications

Stop and turn off machine power. Remove safety guards(s) inspection plates; check for: Chain and sprockets for uneven wear and damage. Loose setscrews, mounting bolts. Tighten as necessary. Correct for chain elongation in accordance with manufacturer's specifications. Start mechanism and test. Note findings in PM Inspection Report with findings and action to be done. Submit report to supervisor for final decision.		assembly and disassembly of chain drive. Observe safety precautions in the inspection of chain drives while the machine is running.	Mechanic's tool box Personal safety equipment Piano wire and tightener Straightedge

Occupation Title: Plant Maintenance Mechanic

Task Analysis Sheet No. ___

Duty No. A	PERFORM PREVENTIVE MAINTENANCE		
Task No. 8	Adjust gibs of slide ways		
Level ___	PERFORMANCE OBJECTIVES: Given a machine mechanism adjustable gibs, lubricants, tools and equipment, the student(s)/trainee(s) must be able to adjust gibs for free operation. The moving part must operate freely without binding or side movement with specified clearance.		
STEPS	**PERFORMANCE CRITERIA**	**RELATED KNOWLEDGE, ATTITUDE AND SAFETY**	**TOOLS, EQUIPMENT, AND MATERIALS**
Remove gibs and wipe/clean area(s). Determine gib clearance on both sides and ends with feeler gages. Check sliding surfaces of mechanism for excessive wear with dial indicator and micrometers.	Moving parts must operate freely, without binding or side movement with specified clearance.	Explain the reasons for using gibs in slide ways. Enumerate the different types or shapes of gibs.	Dial indicator Feeler gages Gib wrenches or slotted screw driver head Mechanic's tool box (hand tools)

Check gib surfaces for excessive wear and galled with dial indicator. Replace, straighten, or scrape if necessary. Adjust gib by loosening screw at small end and tightening screw at large end of gib. Draw up to point of feeling pressure and back off to specified clearance. Lubricate. Operate the mechanism for freedom of operation without side movement.			Oil can Personal safety equipment Scrapers Shim stock (assortment of metal shims) Wiping rags

Occupation Title: Plant Maintenance Mechanic

Task Analysis Sheet No. ___

Duty No. A	PERFORM PREVENTIVE MAINTENANCE		
Task No. 9	Inspect/maintain drive couplings		
Level ___	PERFORMANCE OBJECTIVES: Given a machine, tools and equipment; the student(s)/trainee(s) must be able to inspect and maintain drive couplings. The coupling shall perform smoothly, clean and without vibration and noise.		
STEPS	**PERFORMANCE CRITERIA**	**RELATED KNOWLEDGE, ATTITUDE AND SAFETY**	**TOOLS, EQUIPMENT, AND MATERIALS**
Coordinate with operator regarding the inspection. Observe the drive coupling while it is running: coupling for flying dirt, oil, or grease for any unusual noise generated for any vibration of the part Clean and adjust as necessary Tighten mounting bolts Alignment of coupling halves. Record work done on preventive maintenance inspection form.	Coupling shall be clean and adjusted to perform smoothly without vibration and noise Recommend further action. Inspection report submitted	Explain the operating principle of drive couplings. Enumerate the different types of couplings. Explain the main considerations in the installation of drive couplings. Describe the method of installing drive couplings. Enumerate the different malfunctions of couplings, causes and corresponding remedy.	Coupling Mechanic's tool box Dial indicator Rags Solvents Preventive maintenance Inspection form

Submit preventive maintenance Inspection form to Supervisor Record in Equipment Maintenance Record the maintenance action done.			

Occupation Title: Plant Maintenance Mechanic

Task Analysis Sheet No. ___

Duty No. A	PERFORM PREVENTIVE MAINTENANCE		
Task No. 13	Lubricate seal faces		
Level ___	PERFORMANCE OBJECTIVES: Given the necessary tools, equipment and materials, the student(s)/trainee(s) must be able to lubricate seal faces to manufacturers specifications.		
STEPS	**PERFORMANCE CRITERIA**	**RELATED KNOWLEDGE, ATTITUDE AND SAFETY**	**TOOLS, EQUIPMENT, AND MATERIALS**
Turn off mechanism power. Consult manufacturer's manual. Select lubricant. Wipe off fittings. Lubricate. Wipe off excess lubricant. Start mechanism, observe. Inspect for lubricant leakage.	Lubricated seal must conform to manufacturers specifications.	Knowledge of lubricating oils Knowledge of different seals	Mechanics tool box Lubricant Manufacturers manual Rags

Task Analysis Sheet No. ___

Duty No. A	PERFORM PREVENTIVE MAINTENANCE		
Task No. 14	Participate in safety training program		
Level ___	PERFORMANCE OBJECTIVES: Given an opportunity to participate in a safety training program, the student(s)/trainee(s) must be able to work in the company following the safety precautions and practices in the plant.		
STEPS	**PERFORMANCE CRITERIA**	**RELATED KNOWLEDGE, ATTITUDE AND SAFETY**	**TOOLS, EQUIPMENT, AND MATERIALS**
Handle safely cylinder tanks in moving from one place to another. Lift loads safely.	Observable behavior or safety practices noticeable.	Enumerate the causes of accidents Explain the hidden costs of accidents.	First aid kit Fire extinguisher

Put out fires using appropriate fire extinguishers. Apply first aid for cuts, and burns. Apply artificial respiration. Apply cardio–pulmonary resuscitation.		Describe the safe handling of materials and tools. Enumerate the different types of fires and corresponding fire extinguisher to put it out.	Fire fighting equipment Safety posters

Occupation Title: Plant Maintenance Mechanic

Task Analysis Sheet No. ___

Duty No. A	PERFORM PREVENTIVE MAINTENANCE		
Task No. 15	Orient OJT Trainees on safety and maintenance practices		
Level ___	PERFORMANCE OBJECTIVES: Given the necessary material tools and equipment, the OJT student(s)/trainee(s) must be oriented on safety and maintenance practices. Upon completion the OJT student(s)/trainee(s) can perform machine operating procedures within company's safety standards.		
STEPS	**PERFORMANCE CRITERIA**	**RELATED KNOWLEDGE, ATTITUDE AND SAFETY**	**TOOLS, EQUIPMENT, AND MATERIALS**
Orient the OJT trainee on the physical layout of the plant. Present/discuss plant/department structure and policies. Present/discuss general safety precautions and specific safety on machine operations. Demonstrate job tasks as necessary. Ask for and discuss questions from new employees.	Oriented personnel must be familiar with organization's safety policies and machine operating procedures.	List down the organizational structure of the plant. List down the organizational structure in the maintenance department. Enumerate company regulations regarding: absences and tardiness; Timekeeping; wage computation State the general safety precautions in the plant. Enumerate the different personal safety equipment while doing the job.	Floor plan of facilities Tools Spare parts Company policies Organization's safety and health policies New employee personnel files Personal safety equipment

Occupation Title: Plant Maintenance Mechanic

Task Analysis Sheet No. ___

Duty No. A	PERFORM PREVENTIVE MAINTENANCE
Task No. 16	Perform housekeeping
Level ___	PERFORMANCE OBJECTIVES: Given the necessary tools, equipment and specific work area, the student(s)/trainee(s) must be able to perform

	housekeeping. When completed, the area and equipment must be clean with all tools and devices properly stored.		
STEPS	**PERFORMANCE CRITERIA**	**RELATED KNOWLEDGE, ATTITUDE AND SAFETY**	**TOOLS, EQUIPMENT, AND MATERIALS**
Inspect maintenance area of responsibility Clean enclosing area. Clean area under machines and work tables. Clean Workbench and vise. Clean machine of chips, dust and grime. Dispose off all trashes in an approved area or container. Arrange for acquiring cabinets for storage of lubricants. Arrange lubricants in storage. Clean around lubricant storage. Maintain trash box around the area.	The area and equipment must be clean with all tools and devices properly stored.	Explain the importance of cleanliness in the performance of workers especially maintenance men. Enumerate and explain the Japanese **5S**s of workplace management. Explain the phrase " a place for everything and everything in its place."	Brooms scrapers Scrapers Mops Rags Dustpans Trash cans

Annex C: Worksheets

Standard Time Model for a One−Year Program (First Level)

Recommended for Dual Training System and Dualized Programs

Part 1: 1st Semester (18 weeks)		
16 weeks Fulltime In−School/Center Training to cover the Knowledge Requirements	*2 weeks Industry Immersion*	
1 week = 5 days = 30 hours (h) (6 hours per day)	1 week = 6 days = 48 hours	
16 weeks = 80 days = 480 h	*2 weeks = 12 days = 96 h*	
Note: This number of hours is exclusive to be spent for the Knowledge Requirements. It is possible to add hours for General Educational Subjects, Academics or other activities which are not part of the Dualized Program.	Industry Immersion is a suggested scheme where trainees join in selected firms for familiarization and job induction in a possible company assignment.	
Part 2: 2nd Semester (18 weeks) plus Semestral Break (10 weeks)		
18 weeks		10 weeks
1 day (8 hours) per week In−School/Center Training to cover the Related Knowledge Requirements	*5 days (40 hours) per week In−Firm Training to cover the Skills Requirements*	*6 days (48 hours) per week In−Firm Training to cover the*

		Skills Requirements
18 weeks *"=" 18 days* *= 144 h*	*18 weeks* *"=" 90 days* *= 720 h*	*10 weeks* *= 60 days* *= 480 h*
In−School/Center Training = 144 h	*In−Firm Training = 720*	*+ 480 (= 150 days) = 1200 h*

Summary	In−School/Center	Industry
Part 1 Knowledge Requirements	*480 h (080 days)*	*96 h (012 days)*
Part 2 Skills Requirements	*144 h (018 days)*	*1200 h (150 days)*
	624 h = 32.50 %	*1296 h = 67.50 %*
Total	*1920 h =100.00 %*	

Worksheet 1

by Mr. Jürgen Schwarz
CIM Consultant to TESDA NITVET−CTAD

Dualization of Curriculum: Creating a time frame

Name of participant: _____

Institution: _____

Region: _____

Occupational title (of existing curriculum or Training Regulation):
_____

Creating a time frame. 60 – 70% of the total duration of the program must be imparted by the training company while 30 – 40% should be imparted by the school/training center.

Please decide/answer the following questions and justify your decision:

What level(s)/(class(es) your draft Dualized Core Curriculum shall cover?

Does the existing Training Regulation/Curriculum contain time allotment for Knowledge or Skills Requirements?

How long (Semesters, weeks, days) shall be the total duration of the program? Shall Saturday be included?

For the pilot implementation it is recommended that the first part of the program shall be organized as full time in−school/center, to impart the Knowledge Requirements. It is also recommended that part 1 should include an Industry Immersion as a suggested scheme where trainees join in selected firms for familiarization and job induction of possible company assignment. How long shall be the full time in−school/center part & how long shall be the integrated Industry Immersion (weeks)?

How shall be the time divided between Knowledge Requirements and Industry Immersion (Part 1 of Dualized Core Curriculum) and Skills Requirements (Part 2 Dualized Core Curriculum)? Please indicate the total time for Knowledge Requirements and Skills Requirements (only in weeks):

Knowledge Requirements and Industry Immersion (Part 1):
Skills Requirements (Part 2):

Please create a time model:

Knowledge Requirements & Industry Immersion (Part 1)
= weeks = days

Knowledge Requirements will not only be imparted in Classroom but also in School–Shop. How will be the time divided (days) between Classroom and School–Shop for Part 1? (This should be only a first assessment, which can be changed in the future development)

No.	Topics	Knowledge	Skills	
		Classroom	School–Shop	Industry
	Knowledge Requirements and Industry Immersion (Part 1 of the Dualized Core Curriculum)			
Summary				

Skills Requirements (Part 2)

Skills Requirements will not only be imparted in the Industry but also in School/Training Center. What will be your time model for this part of the Dual Training Program? How many days per week in School/Training Center? Any other model?

According to your decision about the model, please write down:

Skills Requirements (Part 2) Total time = ___ weeks = _ _ _ days

Time to be spent in Industry
= ___ days

Time to be spent in School/Training Center
= ___ days

The time portion for imparting the Skills Requirements in School/Training Center has to be divided between Classroom and School–Shop. (This should be only a first assessment, which can be changed in the future development)

Time portion for Skills Requirements to be imparted in Classroom
= ___ days

Time portion for Skills Requirements to be imparted in School–Shop
= ___ days

No.	Topics	Knowledge	Skills	
		Classroom	School–Shop	Industry

	Skills Requirements (Part 2 of the Dualized Core Curriculum)			
Summary				

Please list the whole time frame of your Dual Training Program.

Check in the total summary whether your time portions for In−School/Training Center and In−Industry are within the demanded 30 – 40 % or 60 – 70 %

No.	**Topics**	**Knowledge**	**Skills**	
		Classroom	School−Shop	Industry
	Summary			
	Knowledge Requirements and Industry Immersion (Part 1 of the Dualized Core Curriculum)			
	Skills Requirements (Part 2 of the Dualized Core Curriculum)			
Total		= ___%		= ___%
		= ___%		

Worksheet 2

by Mr. Jürgen Schwarz
CIM Consultant to TESDA NITVET−CTAD

Dualized Core Curriculum for Knowledge Requirements and Industry Immersion.

Fixing the time portions for classroom, school−shop and industry (Industry Immersion)

Name of participant: _____

Institution: _____

Region: _____

Occupational title (of existing curriculum or Training Regulation):
_____

Please list all topics of the Knowledge Requirements of the existing curriculum or Training Regulation you are going to dualize.

Please allocate the time portions for the particular topics of Knowledge Requirements. Do this according to their importance.

Please decide how much of the time portion for every particular topic should be imparted in classroom and how much should be imparted in school−shop.

Please check with your time frame. Since the time frame was only a first assessment, you can change the time alloted to classroom and school−shop.

Core Curriculum for Knowledge Requirements and Industry Immersion (Part 1 of the Dualized Core Curriculum):

No.		**Knowledge**	**Skills**

	Topics (Knowledge Requirements)			
		Classroom	School–Shop	Industry
				XXXXXXX
				XXXXXXX
				XXXXXXX
				XXXXXXX
				XXXXXXX
				XXXXXXX
				XXXXXXX
				XXXXXXX
				XXXXXXX
				XXXXXXX
	Industry Immersion			
Total				

Worksheet 3

by Mr. Jürgen Schwarz
CIM Consultant to TESDA NITVET–CTAD

Dualized Core Curriculum for Skills Requirements

Fixing the time portions for classroom, school–shop and industry

Name of participant: _____

Institution: _____

Region: _____

Occupational title (of existing curriculum or Training Regulation):
_____

Please list all topics of the Skills Requirements (=Duties of the DACUM Research Chart) of the existing curriculum or Training Regulation you are going to dualize.

Please calculate the time portions for the particular topics of Skills Requirements (Duties). This should be guided by the following consideration: How difficult is the task? How important is the task? How complex is the task?

Please decide how much of the time for every particular Duty will be used in the classroom, school–shop and in the industry.

Please check with your time frame. Since the time frame was only a first assessment, you can change the time for the classroom, school–shop and industry imparted skills.

Core Curriculum for Skills Requirements (Part 2 of the Dualized Core Curriculum):

No.	Topics (Skills Requirements)	Knowledge	Skills	
		Classroom	School–Shop	Industry
	Industry Immersion			
Total				

Please list the total summary (Part 1 and 2) for your Dual Training Program.

Please check (again) in the total summary whether your time portions for In–School/Training Center and In–Industry are within the demanded 30 – 40 % or 60 – 70 %

No.	Topics	Knowledge	Skills	
		Classroom	School–Shop	Industry
	Summary			
	Knowledge Requirements and Industry Immersion (Part 1)			
	Skills Requirements (Part 2)			
Total		= ___%		= ___%
		= ___%		

DCC Form 1

Knowledge Rqmts. & Industry Immersion

PROTOTYPE CORE CURRICULUM

Sector : _____

Occupational Field : _____

Level : _____

Subject : _____

National Certificate : _____

Duration : _____

Duration Part 1 : _____

COURSE CONTENT

Part 1. Based on Knowledge Requirements of _____

(Occupation)

Code: (TR)	**Topics**	**Knowledge**	**Skills**	
		Classroom	School–Shop	Industry
	Industry Immersion			
	Summary	___ days	___ days	___ days
		___ days (hours)		___ days (hours)
	Total	days (hours)		

DCC Form 2

Skills Requirements

PROTOTYPE CORE CURRICULUM

Sector : _____

Occupational Field : _____

Level : _____

Subject : _____

National Certificate : _____

Duration : _____

Duration Part 1 : _____

COURSE CONTENT

Part 1. Based on Skills Requirements of _____

(Occupation)

DTP Form 1

Knowledge Requirements

PROTOTYPE DUALIZED TRAINING PLAN

Drafted by Workgroup : _____

Sector : _____

Occupational Field : _____

Level : _____

Subject : _____

National Certificate : _____

Duration : _____

Duration Part 1 : _____

COURSE CONTENT

Part 1. Based on Knowledge Requirements of _____

(Occupation)

Knowledge Requirements		Objectives	Contents		Learning Hours			Didactical Remarks (Recommendations)
					C	SS	IN	
			Summary					
			Total					

DTP Form 2

Skills Requirements

PROTOTYPE DUALIZED TRAINING PLAN

Drafted by Workgroup : _____

Sector : _____

Occupational Field : _____

Level : _____

Subject : _____

National Certificate : _____

Duration : _____

Duration Part 1 : _____

COURSE CONTENT

Part 1. Based on Skills Requirements of _____

Occupation)

Skill Requirements		Objectives	Contents		Learning Hours			Didactical Remarks (Recommendations)
					C	SS	IN	
			Summary					
			Total					