AS LEVEL Section A

FACT FILES

Technology & Design

For first teaching from September 2011
For first award in Summer 2012

Quality Systems

FACT FILE

technology and design

Learning Outcomes

Students should be able to:
- demonstrate knowledge and understanding of the use of:
  - quality assurance (QA) and quality control (QC) systems;
  - statistical testing methods;
  - factor of safety;
  - use of tolerances;
- demonstrate knowledge and understanding of the purpose of testing and inspection of components or products;
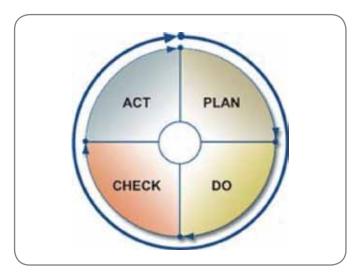
Course Content

What is quality assurance?

Quality assurance (QA) is a process that verifies whether a product meets a customer's expectations so that the manufacturer will retain its credibility.

It is a process with procedures so that goals will be accomplished. This process considers design, development, production, and service.

The Shewhart Cycle, developed by Dr. W. Edwards Deming consists of four steps: **Plan**, **Do**, **Check**, and **Act** (PDCA).

- **Plan:** create objectives and tests required to bring about the best results.
- **Do:** put into practice the course of action developed.
- **Check:** check and evaluate by testing the results versus the objectives set in the beginning
- **Act:** If any changes are required for improvement they are then to be applied.

The purpose is to guarantee that quality is in place for every component throughout the process. The target of quality assurance is to bypass the customers' expectations with the final product.

What is Quality Control?

Quality Control (QC) is a procedure in which quality in a product or service is guaranteed. The main aim is to make sure that the products and services meet required standards and are reliable and satisfactory.

Quality control is the examination of a product or service for certain levels of quality. The aim of a quality control team is to discover products or services that fall short of specified standards of quality.

Quality Control is regularly confused with Quality Assurance. The purpose of quality control is to decide whether the final product is satisfactory while quality assurance ensures the product or service is manufactured in the right way.

Statistical Testing Methods

Statistical Testing Methods refers to the use of statistics to generate the selection of finished products for testing.

Statistical testing methods inferences are decided about standards and quality based on chosen samples. Each item in the sample is tested for a particular quality feature.

The purpose of statistical quality control is to verify when the process has gone out of statistical control, so that a change can take place immediately in order to fix the problem.

The two principal techniques in statistical quality control are:
*   Acceptance Sampling
*   Control Charts

Acceptance sampling

This is when a sample is removed from a set of products. Then depending on the number of products that pass the test; the set is accepted or rejected.

Control chart

This is a simple graphical model to show and control a single feature of the process output.
A control chart helps determine whether variations in your process are due to defects with the product or external circumstances, such as employee mistakes.

Using a control chart shows the effects of alterations to your process and helps you correct any errors in real time. You can also predict the range of possible future results.

A control chart has 3 horizontal lines:
*   **Central line** shows the average of the process output.
*   **The upper and lower control** confines point out severe statistical values of the process output.

If a value of the output is outside the upper or lower control limit then the process is out of control and needs to be assessed to determine the reason.

Factors of Safety

Safety in manufacturing means safe design, manufacture, use and the disposal of products. It is important that safety procedures are followed along with standards, regulations, and legislation checked. All of these processes are to make sure that the particular product being manufactured is safe for the consumer, the producer and the environment.

What are Tolerances?

Tolerances provide the maximum (+) and minimum (-) deviation from the actual value that will still allow it to do its job.

Purpose of Testing and Inspection

Testing is a process in which the product is observed during operation to establish if it works properly for a set period of time.

Inspection is the action of examining the product or its components to determine if they achieve the standards set at the beginning.

For example in the automotive industry there is an inspection of a vehicle's components, usually done by a certified mechanic. Vehicles will pass the inspection when the mechanic provides evidence for the proper working condition of the vehicle systems specified at the beginning. Inspection and testing are the working parts of quality control, arguably the most important factor to the continued existence of any manufacturing company.

Quality Control helps with:
- Factors of cost;
- Productivity;
- On-time delivery; and
- Market share.

It is important that inspection and testing are carried out through each stage of the process so that the required levels of quality and design standards are high.

Other reasons why a company test and inspect products and operations are:
- To avoid expensive recalls;
- To ensure the product or components are capable of doing what they were designed to do;
- To avoid bad publicity; and
- Ensure consistency/quality of product manufacture.