**1.4. DEVELOPMENTOFTESTING**

Materials testing, measurement of the characteristics and behavior of such substances as metals, ceramics, or plastics under various conditions by a full- or small-scale model of a proposed machine or structure may be tested. Alternatively, investigators may construct mathematical models that predict capabilities of the structure. Standard test methods have been established by such national and international bodies as the International Organization for Standardization (ISO).

**a) Identify the Need& Define the Problem**

The first step is to identify and define the problem. The following major problem, which needs to consider during development of material testing.

- ✓ A problem can be regarded as a difference between the actual situation and the desired situation. It involves diagnosing the situation so that the focus on there all problem.
- ✓ Development of a new manufacturing processing line or making changes to an existing one, needs an improvement of testing method sunder different conditions and in different applications.
- ✓ Improvement of Troubleshooting, to determine what is causing issues during processing.
- ✓ Scale-up of a testing technology.
- ✓ Increase fundamental understanding of materials.
- ✓ Improvement of the process/product performance relative to demands of customers.
- ✓ Reduction of existing process spread, which lead stop or capability.

**(b) Research the Problem**

- ✓ Some possible ways to identify potential process by using knowledgeoftheprocess,historicaldata,cause-and-effectanalysisandbrainstorming, etc.,

- ✓ The research of problem may concern of a condition to be improved, a difficulty to be eliminated, or a troubling question that exists in literature or testing techniques, specific issue, contradiction or gap between present and future testing techniques in that need of meaningful understanding and deliberate investigation.
- ✓ Ifimportantfactorsareleftoutduringdevelopmentoftestingexperiment,then the results of the experiment will not be accurate which must be take care.

**(c) Develop possible testing methods**

- ✓ The size of the testing is dependent on the number of factors or interactions to be studied, the number of levels of each factor, budget and resources allocated for carrying out the experiment, etc.
- ✓ The development testing plan methods is done using various techniques of graphical presentation, such as Autocad, simulation techniques methods, etc.
- ✓ During the design stage, it is quite important to consider the confounding structure and resolution of the design.
- ✓ The material testing code book gives the basics of testing develop standards, which is based on environment, material specification and analysis methods etc.

**(d) Evaluate the Alternatives & Select Most Promising methods**

- ✓ The various possible method is developed and stimulated in softwares ensure the theoretical acceptance.
- ✓ Pre presenting the information of testing methods are deciding criteria of effective method.
- ✓ The testing methods need to satisfy the basic criteria like cost and time
- ✓ The combination of different testing methods is also selected for the effectiveness.

**(e) Initial Design**

- ✓ The initial design is often made on the basis of avoiding stresses the exceed the yield strength of the material. Then the design is checked by more refined analysis, and changes are made as necessary to avoid more subtle modes of material failure, such as fatigue, brittle fracture, and creep.
- ✓ In making design decisions that involve safety and durability, the concept of a safety

factor is often used. The safety factor in stress is the ratio of the stress that causes

failure to the stress expected to occur in the actual service of the component. That is,

X 1= stress causing failure/stress in service

**(f)Construct a prototype**

- ✓ The materials that will be used in final testing methods may be expensive or difficult to fabricate, so prototypes may be made from different materials than the final product. In some cases, the final production materials may still be undergoing development themselves.
- ✓ A prototype, or trial model, is often made and subjected to simulated service testing to demonstrate whether it is functions properly.
- ✓ Prototypes are generally made with much closer individual inspection and the assumption that some adjustment or rework will be part of the fabrication process.
- ✓ Prototypes may also be exempted from some requirements that will apply to the final product.

**(g) Test and Evaluate the Prototype**

- ✓ It is important to test and evaluate your prototype along the way for functionality, usefulness, and safety. The final product may be subject to a number of quality assurance tests to verify conformance with drawings of specifications.
- ✓ These tests may involve custom inspection fixtures, statistical sampling methods, and other techniques appropriate for ongoing production of a large quantity of the final product.
- ✓ The failure of prototype leads to choosing alternatives and redesign the section.
- ✓ The early estimate of loads may have been quite uncertain. A prototype may also be subjected to simulated service testing until either a mechanical failure occurs, perhaps

by fatigue, creep, wear, or corrosion, or the design is proven to be reliable. This is called durability testing.

- ✓ For very large items, it may be impractical or uneconomical to test a prototype of the entire item. A part of the item, that is, a component, may then be tested.

**(h) Communicate the Design**

- ✓ Communication design is a mixed discipline between design and information-development which is concerned with such as printed, crafted, electronic media or presentations to communicate with people for overcoming some unreliable problems.

**(i)Redesign**

- ✓ The redesign is approached existing testing techniques is outdated for the present materials and to minimizing the calibration.

**Example for development of testing**

*DEVELOPMENT OF MECHANICAL TESTING*-Structures and machines, or their components, fail because of fracture or excessive deformation. In attempting to prevent such failure, the designer estimates how much stress (load per unit area) can be anticipated, and specifies materials that can withstand expected stresses.

* Test machine grips are designed to transfer load smoothly into the test piece without producing local stress concentrations.

*DEVELOPMENT OF STATIC COMPRESSION*-Tests determine a material's response to crushing, or support-type loading (such as in the beams of a house). Testing machines and extensometers for compression. Tests resemble those used for tension tests.

*DEVELOPMENT OF STATICS HEAR AND BENDING TESTS*- In plane shear tests indicate the deformation response of a material to forces applied tangentially Shear strength of rivets and other fasteners also can be measured.

*DEVELOPMENT OF MEASURES OF DUCTILITY*-Ductility is the capacity of a material to deform permanently in response to Ductility can be expressed as strain, reduction in area, or toughness Reduction in area (change in area per unit area) may be measured, for example, in the test section of a steel bar that necks when stressed.

*DEVELOPMENT OF HARDNESS TESTING*- Based on the idea that a material's response to a load placed at one small point is related to its ability to deform permanently (yield), the hardness test is performed by pressing a hardened steel ball (Brinell test) or a steel or diamond cone (Rockwell test) into the surface of the test piece.

*DEVELOPMENT OF IMPACT TEST*-Many materials, sensitive to the presence of flaws, cracks, and notches, fail suddenly under impact.

*DEVELOPMEN TO FFRACTURE TOUGHNESS TESTS*-The criterion for failure became sudden propagation of a crack rather than fracture. Tests have shown that cracks occur by opening, when two pieces of material part in vertical plane, one piece going up, the other down; by edge sliding, where the material splits in horizontal plane, one piece moving left, the other right; and by tearing, where the material splits with one piece moving diagonally upward to the left, the other moving diagonally downward to the right.

*DEVELOPMENT OF CREEP TEST*-Creep is the slow change in the dimensions of a material due to prolonged stress; most common metals exhibit creep behavior. In the creep test, loads below those necessary to cause instantaneous fracture are applied to the material, and the deformation over a period of time (creep strain) under constant load is measured, usually with an extensometer or strain gauge.

*DEVELOPMENT OF FATIGUE TEST*-Materials that survive a single application of stress frequently fail when stressed repeatedly. This phenomenon, known as fatigue, is measured by

mechanical tests that involve repeated application of different stresses varying in a regular cycle from maximum to minimum value.