

**IMPORTANT QUESTION & ANSWERS**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**Subject code: GE6757**

**Subject Name: TOTAL QUALITY MANAGEMENT**

**Regulation: 2013**

**Year/Semester: IV/ VII**

Anna University , Chennai-25  
Syllabus  
Regulation 2013  
GE 6757 - TOTAL QUALITY MANAGEMENT

**OBJECTIVES:**

To facilitate the understanding of Quality Management principles and process.

**UNIT I INTRODUCTION 9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

**UNIT II TQM PRINCIPLES 9**

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS AND TECHNIQUES I 9**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

**UNIT IV TQM TOOLS AND TECHNIQUES II 9**

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

**UNIT V QUALITY SYSTEMS 9**

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

### **1. Aim & Objective of the subject**

- To learn the quality philosophies and tools in the managerial perspective.
- To determine the voice of the customer and the impact of quality on economic performance and long-term business success of an organization.
- To apply and evaluate best practices for the attainment of total quality.
- To learn the concept of six sigma which measures highest quality of the product.

### **2. Need & Importance of the subject**

- ❖ This subject will give a basic knowledge in TQM tools which improve the quality of the product.
- ❖ This subject will enhance the knowledge of quality principles and techniques.

### **3. Industrial Connectivity & Latest Development**

- QFD - Applied in manufacturing sector
- FMEA-Applied in automobile sector
- ISO 9000-2000 Certificate issued for all industries

**Department of Mechanical engineering  
Detailed Lesson Plan**

**Name of the Subject& Code: GE 6757 -TOTAL QUALITY MANAGEMENT**

**TEXT BOOK:**

1. Dale H. Besterfield, et al., "Total quality Management", Third Edition, Pearson Education Asia, Indian Reprint, 2006.

**REFERENCES:**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
4. Dr.V.Jayakumar,"Total Quality Management", Lakshmi Publications, 5<sup>th</sup> Edition,2013

S.No	Unit	Topics To Be Covered	Hours Planned	Cumulative Hours	Books Referred
<b>UNIT I – INTRODUCTION</b>					
1.	I	Introduction - Need for quality Evolution of quality – Definition of quality	1	1	T1& R4
2.	I	Dimensions of manufacturing and service quality	1	2	T1& R4
3.	I	Basic concepts of TQM Definition of TQM – TQM Framework	1	3	T1& R4
4.	I	Contributions of Deming	1	4	T1& R4
5.	I	Contributions of Juran&Crosby	1	5	T1& R4
6.	I	Barriers to TQM	1	6	T1& R4
7.	I	Customer focus – Customer orientation, Customer satisfaction	1	7	T1& R4
8.	I	Customer complaints, Customer retention	1	8	T1& R4
9.	I	Cost of Quality	1	9	T1& R4
<b>UNIT II -TQM PRINCIPLES</b>					
10.	II	Leadership	1	10	T1& R4
11.	II	Strategic quality planning, Quality Council	1	11	T1& R4
12.	II	Quality circles	1	12	T1& R4

13.	II	Employee involvement – Motivation, Empowerment	1	13	T1& R4
14.	II	Team and Teamwork,	1	14	T1& R4
15.	II	Recognition and Reward	1	15	T1& R4
16.	II	Performance appraisal	1	16	T1& R4
17.	II	Continuous process improvement – PDSA cycle, 5s, Kaizen	1	17	T1& R4
18.	II	Supplier partnership – Partnering, Supplier selection, Supplier Rating	1	18	T1& R4
<b>UNIT-III -TQM TOOLS AND ECHNIQUES I</b>					
19.	III	The seven traditional tools of quality	2	20	T1& R4
20.	III	New management tools	2	22	T1& R4
21.	III	Six-sigma: Concepts, methodology	1	23	T1& R4
22.	III	Applications to manufacturing, service sector including IT	1	24	T1& R4
23.	III	Bench marking– Reason to bench mark	1	25	T1& R4
24.	III	Bench marking process	1	26	T1& R4
25.	III	FMEA – Stages, Types	1	27	T1& R4
<b>UNIT IV - TQM TOOLS AND TECHNIQUES II</b>					
26.	IV	Control Charts	1	28	R4
27.	IV	Process Capablity	1	29	R4
28.	IV	Concepts of Six Sigma	1	30	T1 R4
29.	IV	Quality Function Deployment (QFD)	2	32	T1& R4
30.	IV	Taquchi Quality Loss Function	1	33	T1& R4
31.	IV	TPM – Concepts, improvement needs	2	35	T1& R4
32.	IV	Performance measures	1	36	T1& R4
<b>UNIT V -QUALITY SYSTEMS</b>					
33.	V	Need for ISO 9000	1	37	T1& R4
34.	V	ISO 9000-2000 Quality System – Elements	2	39	T1& R4
35.	V	Documentation	1	40	T1& R4
36.	V	Quality auditing- QS 9000	1	41	T1& R4
37.	V	ISO 14000 – Concepts, Requirements and Benefits	2	43	T1& R4
38.	V	TQM implementation in production and service sectors	2	45	T1& R4

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**UNIT I**  
**INTRODUCTION**

**PART A**

**1. Define quality. How is quality defined give any two definitions. (Nov/Dec 2011)(NOV DEC 2015)**

Quality is the totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs.

Q = P/E

Q – Quality

P – Performance

E – Expectations.

It is also defined as the degree of excellence a product or service provides.

According to Deming “It is the predictable degree of uniformity, at low cost and suited to the market”. According to Joseph Juran “Quality is fitness for use”. According to Philip B. Crosby “Quality is conformance to requirements

**2. Define TQM. (Nov/Dec 2013)**

Total Quality Management is the management approach of an organization, centered on quality, based on the participation of all its members and aiming at long-term success through customer satisfaction, and benefits to all members of the organization and to society

The Simple Objective of TQM

“Do the right things, right the first time, every time.”

**3. What are the basic concepts that a successful TQM programme requires**

**(Nov/Dec 2013)**

- Top management commitment
- Focus on the customer
- Effective employee involvement
- Continuous improvement
- Treating suppliers as partners
- Establishing performance measures

**4. Mention any four principles of TQM.(Nov/Dec 2009)**

- Customers requirements must be first time ,every time
- Everybody must be involved from all levels and across all functions
- Top management’s participation and commitment is must
- A culture of continuous improvement must be established

**5. What are the pillars of TQM?(Nov/Dec 2008)**

- Problem solving discipline
- Interpersonal skills
- Team work
- Quality improvement process

**6.What is meant by customer retention? (Nov/Dec 2012)**

Customer retention is the process of retaining the existing customers.

**Importance:**

- Over 60% of an organization's future revenue will come from existing customers
- A 2 % increase in customer retention has an equivalent impact upon profitability as a 10 % reduction in operating costs.
- 91% of the unhappy customers will never purchase goods and services from you again
- It costs 5 times as much to attract a new customer as it costs to keep an old one.

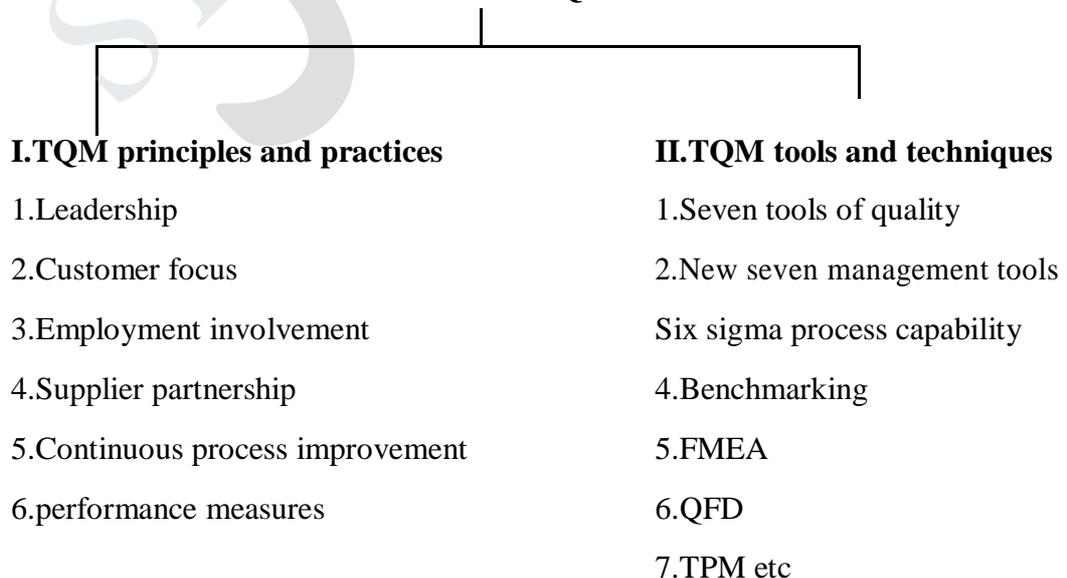
**7. Define the concept of quality control and Write an example for quality statement.**

Quality control is a process by means of which we observe the actual performance and compare it with some standard

Example:"To continuously enrich knowledge base of practitioners in mobility industry and institutions in the service of humanity"-Society of automotive Engineers (SAE)

**8. What are elements of TQM?(May/June 2013) (AU NOV/DEC- 2014)**

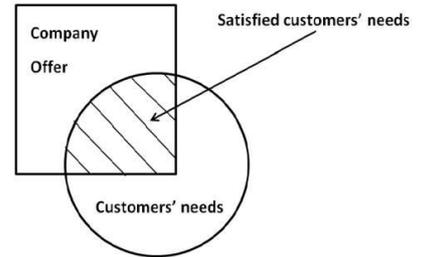
**Elements of TQM**



**9.What is the relationship between competition and customer focus?**

Teboul’s model of customer satisfaction

Customer needs are represented by circle and square represents products or service offered by the company. Intersection portion denotes customer satisfaction. So it is understood that company should strive for increasing the intersection portion



ie, Customer satisfaction.

**10.What do you mean by service quality? (May/June 2013)**

Service quality also known as the quality of customer service, is the set of activities an organization uses to satisfy the customers and their needs

**11.What are the four absolutes of quality observed by crossby? (Nov/Dec 2012) (May/June 2017)**

- First absolute:** The definition of quality is conformance to requirements, not goodness
- Second absolute:** The system of causing quality is preventive, not appraisal
- Third absolute:** The performance standard must be zero defects not that’s close enough
- Fourth absolute:** The measurement of quality is the price of non-conformance, not indexes.

**12.What are the advantages of implementing TQM? (Nov/Dec 2014)**

Tangible benefits	Intangible benefits
<ul style="list-style-type: none"> <li><input type="checkbox"/> Improved product quality</li> <li><input type="checkbox"/> Improved productivity</li> <li><input type="checkbox"/> Reduced quality costs</li> <li><input type="checkbox"/> Increased market and customers</li> <li><input type="checkbox"/> Increased profitability</li> <li><input type="checkbox"/> Reduced employee grievances</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Improved employee participation</li> <li><input type="checkbox"/> Improved teamwork</li> <li><input type="checkbox"/> Improved working relationships</li> <li><input type="checkbox"/> Improved customer satisfaction</li> <li><input type="checkbox"/> Improved communication</li> <li><input type="checkbox"/> Enhancement of job interest</li> <li><input type="checkbox"/> Enhanced problem-solving capacity</li> </ul>

**13. What are the dimensions of Quality?(AU MAY/JUNE- 2013), (AU NOV/DEC-2013)**

The dimensions of Quality are:

1. Performance – Primary product characteristics such as the brightness of the picture.
2. Features – Secondary characteristics, added features, such as remote control.
3. Conformance – Meeting specifications or industry standards.
4. Reliability – Consistency of performance over time, average time for the unit to fail.
5. Durability – Useful life includes repair.
6. Service – Resolution of problems and complaints, ease of repair.
7. Response – Human to human interface, such as the courtesy of the dealer.

**14. What are the barriers to TQM ? (AU MAY/JUNE- 2013)**

The main barriers to TQM are as follows :

- i. Lack of understanding of the TQM concept
- ii. Absence of visible support from senior & Top management
- iii. Fear of change
- iv. Poor internal communication
- v. Heavy work loads
- vi. Nature of organization
- vii. Lack of adequate education & training
- viii. Limited resources
- ix. Irregularity of the meetings
- x. Delay in implementation of the recommendation
- xi. Difficulties in evaluation

**15. What are the different ways to create customer oriented culture in a industry?(NOV/DEC2016)**

Performance  
Features  
Service  
Warranty  
Price  
Reputation

**16. What are the categories of quality cost?( NOV/DEC2016)**

Various types of costs associated with Quality are

- Prevention cost
- Appraisal cost
- Internal Failure cost and

**PART B**

**1. Explain the various dimensions of quality with examples (Nov/Dec 2012)  
(Nov/Dec 2011)(May/June 2013)(NOV/DEC 2016) (May/June 2017)**

Depending upon the needs of the customers any product has to be supplied by the manufacturer. However the product should have certain characteristics and features. Customers only determine ultimately whether the product has been of expected quality. Various dimensions of quality that the customers do look for in a product, in order to satisfy their needs, only decide the characteristics of a product.

Two categories:

- Dimensions of product(or manufacturing)quality
- Dimensions of service quality

**Dimensions of product Quality:**

Quality of product can be evaluated by customers using nine dimensions/aspects of the product.

1. **Performance** – Primary product characteristics such as the brightness of the picture. This is the driving force deciding the operating characteristics.
2. **Features** – Secondary characteristics, added features, such as remote control. Though this attribute is a secondary characteristic, it necessarily supplements the basic functioning of the product.
3. **Conformance** – Meeting specifications or industry standards. How far the products physical and performance characteristic match with the set standards is called conformity.
4. **Reliability** – Consistency of performance over time, average time for the unit to fail. Under prescribed conditions of use of the product the probability of surviving over a specified period is termed as reliability of that product.
5. **Durability** – Useful life includes repair. The quantum of use a customer gets from a product before it wears out beyond further use or when a replacement is essential is called durability.
6. **Service** – Resolution of problems and complaints, ease of repair. The possibility to repair a product quickly and with ease is serviceability.
7. **Response** – Human to human interface, such as the courtesy of the dealer. It refers to the degree they react and act quickly to resolve the problems.
8. **Aesthetics** – Sensory characteristics such as exterior finish. It is the manner in which a product looks feels, tastes or smells.

9. **Reputation** – Past performance and other intangibles, such as being ranked first.

**Dimensions of service quality:**

Quality of Service is judged by the customers on many dimensions in addition to the physical and functional characteristics associated with the service.

The various aspects or dimensions of service which are found to be very important in determining customer perception of service quality include:

1. Reliability 2. Responsiveness 3. Assurance 4. Empathy 5. Tangibles 6. other dimensions

1. **Reliability:** Reliability refers to the dependability of the service providers and their ability to keep their promises.

2. **Responsiveness:** Responsiveness refers to the reaction time of the service.

3. **Assurance:** Assurance refers to the level of certainty a customer has regarding the quality of the service provided.

4. **Empathy:** Empathy is being able to understand the needs of the customer as an individual and meet the special requirements of the customer.

5. **Tangibles:** This refers to the physical characteristics of facilities, equipments, Consumable goods and personnel used in or associated with the service provided.

6. **Other dimensions**

Time – This is the duration up to which a customer is made to wait.

Timeliness – It refers to whether the promise can be kept or whether the service can be performed as promised.

Courtesy – Whether the front office sales people greet each customer cheerfully and politely.

Consistency – Whether the services are delivered in the same manner for every customer and every time for the same customer.

Accessibility and convenience – Whether the service is easy to get or must the customer influence the service provider to get the required service.

Accuracy – This is with regard to whether the service is done correctly even in the first instance.

Responsiveness – Whether the service person reacts and acts quickly to resolve problems.

**2.What are the barriers for TQM implementation and how are they overcome?**

(Nov/Dec 2013) (Nov/Dec 2012)(NOV/DEC2014) (NOV/DEC2015)(NOV/DEC2016)

- Lack of management commitment
- Lack of faith in and support to TQM activities among management personnel
- Failure to appreciate TQM as a cultural revolution. In other words,inability to change organizational culture
- Misunderstanding about the concept of TQM.
- Improper planning
- Lack of employees“ commitment.
- Lack of effective communication.
- Lack of continuous training and education
- Lack of interest or incompetence of leaders
- Ineffective measurement technique and lack of access to data and results.
- Non-application of proper tools and techniques
- Inadequate use of empowerment and team work
- Inadequate attention to internal and external customers
- Delay or non-implementation of quality improvement team“s recommendations.

**3.Write the fourteen steps of Deming’s philosophy for improving quality, productivity and competitiveness April 2013 ,April 2014,May 2015**

Deming’s philosophy is given in his 14 points. Most of these were explained in a seminar for 21 presidents of leading Japanese industry in 1950.

**Deming’s 14 points on route to quality**

- 1.** Create constancy of purpose toward improvement of product and service, with the aim to become competitive and to stay in business, and to provide jobs.
- 2.** Adopt the new philosophy. We are in a new economic age. Western management must awaken to the challenge, must learn their responsibilities, and take on leadership for change.

3. Cease dependence on inspection to achieve quality. Eliminate the need for inspection on a mass basis by building quality into the product in the first place.
4. End the practice of awarding business on the basis of price tag. Instead, minimize total cost. Move toward a single supplier for any one item, on a long-term relationship of loyalty and trust.
5. Improve constantly and forever the system of production and service, to improve quality and productivity, and thus constantly decrease costs.
6. Institute training on the job.
7. Institute leadership .The aim of supervision should be to help people and machines and gadgets to do a better job. Supervision of management is in need of overhaul, as well as supervision of production workers.
8. Drive out fear, so that everyone may work effectively for the company
9. Break down barriers between departments. People in research, design, sales, and production must work as a team, to foresee problems of production and in use that may be encountered with the product or service.
10. Eliminate slogans, exhortations, and targets for the work force asking for zero defects and new levels of productivity. Such exhortations only create adversarial relationships, as the bulk of the causes of low quality and low productivity belong to the system and thus lie beyond the power of the work force.
  - Eliminate work standards (quotas) on the factory floor. Substitute leadership.
  - Eliminate management by objective. Eliminate management by numbers, numerical goals. Substitute leadership.
11. Remove barriers that rob the hourly worker of his right to pride of workmanship. The responsibility of supervisors must be changed from sheer numbers to quality.
12. Remove barriers that rob people in management and in engineering of their right to pride of workmanship. This means, inter alia, abolishment of the annual or merit rating and of management by objective.
13. Institute a vigorous program of education and self-improvement.
14. Put everybody in the company to work to accomplish the transformation. The transformation is everybody's job.

**4(a).Discuss the contributions Juran in detail./ (May/June 2012)(NOV/DEC2015)**

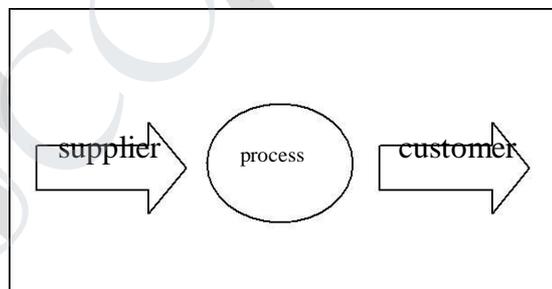
Juran is an American scientist and he was exposed to concepts of shewart , he has published more than 100 papers and 12 books , and emphasizes on the necessity for management at all levels to be committed to quality and its improvement . His contribution towards quality comprise the following aspects.

1. Internal customer
2. Cost of quality
3. Quality trilogy
4. Juran's 10 steps for quality improvement;
5. The breakthrough concept

**1. Internal customer**

Juran realized that the customer was not just the end customer and that each person along the chain has an internal customer. Each person along the chain,from product designer to final user, is a supplier and a customer.

In addition,the person will be a process,carrying out some transformation or activity.Therefore Juran maintained that at each stage was a "three role model":Supplier, process and customer



**2.Cost of quality:**

Quality costs are defined as those costs associated with the non-achievement of product/service quality as defined by the requirements established by the organization and its contracts with customers and society.

Juran's classified the cost of quality into four classes as:

**(i)Internal Failure costs:** Scrap,rework,corrective actions,

**(ii)External Failure Costs:** warranty claims,customer complaints and loss of customer.

**(iii)Appraisal costs:** Inspection, compliance auditing and investigations.

**(iv)Prevention costs:** Training,preventive auditing and process improvement implementation.

### 3.Juran's quality trilogy:

Juran view as quality as fitness –for-use. He also believes that roughly 80% of quality defects are management controllable. Thus management has the responsibility to correct this deficiency.

Juran divides quality management into three parts. They are given below:

**1. Quality planning:** Objectives are to determine quality goals; to form implementation planning; to do resource planning; to express goals in quality terms; and to create the quality plan.

**2. Quality control:** Objectives are to monitor performance; to compare objectives with achievements; and to act to reduce the gap.

**3. Quality improvement:** Objectives are to reduce waste; to enhance logistics; to improve employee morale; to improve profitability; and to satisfy customers

Juran's quality trilogy:

#### 1.Quality Planning

- Identify the customer
- Determine the customer's needs
- Develop product features
- Establish quality goods
- Develop a process
- Prove process capability

#### 2.Quality Control

- Choose control subjects
- Choose units of measurement
- Establish measurement
- Establish standards of performance
- Measure actual performance
- Interpret the difference(actual vs. standard)
- Take action on the difference

#### 3.Quality Improvement

- Prove need for improvement
- Identify specific projects for improvement

- Organise to guide the projects
- Organise for diagnosis-for discovery of causes
- Diagnose to find the causes
- Provide remedies
- Prove that remedies are effective under the operating conditions
- Provide for control to hold gains

**4. Juran's 10 steps for quality improvement;**

- Build awareness of need and opportunity for improvement
- Set goals for improvement
- Organize to reach your goals
- Provide training.
- Carry out projects to solve problems
- Report progress
- Give recognition
- Communicate result.
- Keep score
- Maintain momentum by making annual improvement part of the regular process of the company

**5. The breakthrough concept**

This splits it up into two areas: the journey from symptom to cause and the journey from cause to remedy.

**4(b). Define quality. Explain the evolution of quality. (Nov/Dec 2013)**

Quality is the totality of features and characteristics of a product or service, that bear on its ability to satisfy stated and implied needs of the customer.

Time	Events
	<b>Until 1960s</b>
Prior to the 20 <sup>th</sup> century	Quality is an art Demands overcome potential production An era of Workmanship
F.Taylor 1900s	The scientific approach to management resulting in rationalization of work and its break down leads to greater need for standardization, inspection and Supervision
Shewart 1930s	Statistical beginnings and study of quality control. In parallel, studies by R A Fisher on experimental design; the beginning of control charts at western Electric in USA
Late 1930s	Quality standards and approaches are introduced in France and Japan. Beginning of SQC, reliability and maintenance engineering
1942	Seminal work by Deming at the ministry of war in USA on quality control and sampling. Working group setup by Juran and Dodge on SQC in US army Concepts of acceptance sampling devised
1944	Daodge and Deming carried out seminal research on acceptance Sampling
1945	Founding of the Japan standard association
1946	Founding of the ASQC (American Society for Quality Council)
1950	Visit of Deming in Japan at the invitation of Ishikawa
1951	Quality assurance increasingly accepted
1954	TQC in Japan ; Book published 1956

**5(a). Explain the 6 basic concepts of TQM (Nov/Dec 2011) (NOV/DEC 2015)  
Write down the underlying principles of TQM. (NOV/DEC 2016)**

**Top management commitment**

Top management should participate and completely involve in the total quality programme. They should ensure their complete commitment to the approach through management meetings, company magazines or newsletter. Also, top management should make sure that everybody within the organization from top to bottom is communicated about the TQM programme.

**Focus on the customer**

Achieving customer satisfaction is the heart of TQM. Customers include both internal and external customers. So focus on the customer is the key for any TQM programme.

**Effective involvement and utilization of the entire work force**

Total quality recognizes that each person is responsible for the quality of his work and for the work of the group. All persons must be trained in TQM, Statistical Process Control (SPC) and other appropriate quality improvement skills so that they can effectively participate on quality teams.

**Continuous improvement**

TQM is based on the quest for progress and improvement. TQM believes that there is always a better way of doing things, way to make better use of the company's total quality resources, a way to be more productive. For this purpose various quality tools and techniques may be used.

**Treating suppliers as partners**

Since the suppliers influence the company's quality, therefore a partnering relationship should be developed between management and the suppliers.

**Establishing performance measures for the processes**

Quantitative data are necessary to measure the continuous quality improvement activity. Therefore performance measures such as uptime, productivity, sales turnover, absenteeism, percent non-conforming, customer satisfaction etc. should be determined for each functional area. These results can be used for further improvement activities.

**5(b). Write about quality statement (May /June 2013)**

**Quality statements:**

Quality statements are established by the quality council to provide overall direction for achieving the total quality culture.

Three elements of quality statements are:

**(2 marks)(Nov/Dec 2013)**

1. Vision statements
2. Mission statement
3. Quality policy statement

**1. Vision statement:**

- The vision statement is a short declaration of what an organization aspires to be tomorrow.
- The vision should be coined in such a way that the leaders and the employees working in the organization should work towards the achievements of the vision statement.
- A well-written vision statement, regardless of the type of organization, has the following characteristics:
  - Is easily understood by all stakeholders
  - Is briefly stated, yet clear and comprehensive in meaning
  - Is challenging, yet attainable etc..

Example: "to be the leading customer battery company in the world" - Duracell International

**2. Mission statement:**

The Mission statement is usually one paragraph, describes the function of the organization. It provides a clear statement of purpose for employees, customers and suppliers.

Key elements of a mission statement:

- Obligation to stakeholders:** The most important stakeholder and the relative emphasis placed on meeting the needs of various stakeholders.
- Scope of the business:** The areas in which the company will compete defined by the customers served, the functions provided, and the technology employed.
- Sources of competitive advantage:** The skills that the company will develop/leverage to achieve its vision and a description of how the company

intends to exceed in creating customer value and competitive advantage

- View of the future: The anticipated regulatory, competitive and economic environment in which the company must compete.

Example: "We exist to create, make, and market useful products and services to satisfy the needs of the customer throughout the world"-Texas Instruments.

**3. Quality policy statement:**

The quality policy is a guide for everyone in the organization as to how they provide products and service to the customers.

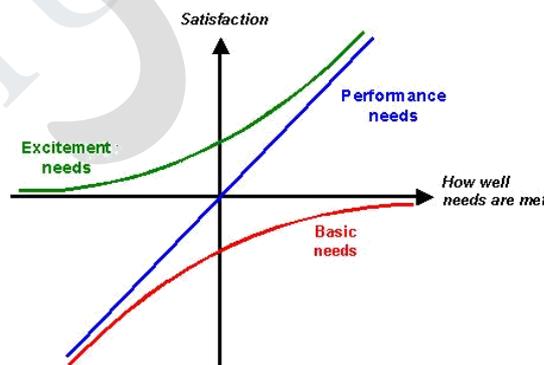
- A quality policy is an important requirement of ISO 9000 quality systems. ISO 9000, the international standard for quality for quality assurance, requires a quality policy as a declaration of intent to meet the needs of the customers.

**6(a). Briefly discuss on customer satisfaction. Also explain customer perception of quality.**

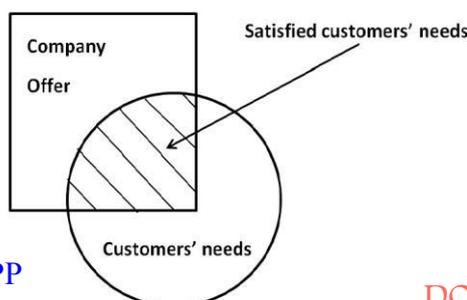
**What is service quality. Explain its various elements towards customer satisfaction. (NOV/DEC 2014) (NOV/DEC 2016) (May/June 2017)**

The purpose of TQM's purpose is meeting or exceeding customer expectations, so that the customers are delighted. It is understood that the customer satisfaction must be the primary goal of any organization. Therefore it is essential that every employee in the organization understands the important of the customer.

**Customer Satisfaction model:**



Customer needs are represented by circle and square represents products or service offered by the company. Intersection portion denotes customer satisfaction. so It is understood that company should strive for increasing the intersection portion ie, Customer satisfaction.



Teboul's model of customer satisfaction

**Kano Model of customer satisfaction (understanding customer needs)**

- It is useful to understand customer needs.
- The kano model of customer satisfaction classifies product attributes based on how they are perceived by customers and their effect on customer satisfaction.
- The kano model is useful for:
  - Identifying customer needs
  - Determining functional requirements
  - Concept development
  - Analyzing competitive product

**Customer perception of quality:**

Quality is what customer perceives it to be. As the customer go on changing their needs, the quality level needs are to be improved continuously to meet the customers demand.

An American Society for Quality (ASQ) survey ranked the customer perception in the following order:

1. Performance      2.Features    3.Service      4.Warranty      5.Price      6.Reputation

**1. Performance:** It indicates that the product and services is ready for the customers' use at the time of sale.

**2. Features:** Secondary characteristics of the product or services.

Example: The primary of cell phone is for communication whereas other facilities such as calculator, alarm are features of the cell phone

**3. Service:** Customer service is intangible in nature. Objective of an organization is to provide good quality to the customer at the right time, even though they are not complaining about their service.

**4. Warranty:** It is public promise of a quality product.

**5. Price:** Nowadays customer is willing to pay a higher price to obtain value. Also customers expect high quality products at the lowest price. Customer evaluating all the organization.

**6. Reputation:** Customers are willing to buy products or service from known and trusted and reputed organization.

**6(b).What is the various methods/tools used for collecting customer complaints?**

**Customer complaints:**

A customer compliant may be defined as an expression of dissatisfaction with a

product/service, either orally or in writing, from an internal or external customer.

**Why customer complaints?**

- To discover customer dissatisfaction
  - To identify customer needs
  - To discover relative priorities of quality etc.
1. Customer complaints related to products:
- Product is defective
  - Product did not meet the basic requirements etc.
    - Service department responding to the problem
    - Speed of response to a compliant call etc.

**Common Customer Feedback Collection Tools**

**(Tools used for collecting Customer complaints)**

1. Comment cards
2. Customer questionnaire
3. Post-transaction surveys
4. Report (feedback) cards
5. Focus groups
6. Social media
7. Toll free telephone numbers
8. Customer visits
9. Employee feedback

**1. Comment cards**

Comment cards are normally attached, to the warranty card, issued with the product at the time of sales. It is completed later and mailed back.

**2. Customer questionnaire**

A customer questionnaire, also known as a survey, is a more effective and also a popular tool for obtaining opinions and perceptions about organization ads its product and services.

Survey include:

- Survey through mail
- Survey through E-mail
- Survey through

telephone

Particularly online, phone and mail survey are most frequently used methods to collect customer feedback.

**Types of online surveys:**

**E-mail:** Survey is emailed to customer, either as a link to a web based survey, or questions are included in the body of the email.

**Pop-up:** "pop ups" are request for feedback after a visitor has landed on company website.

**Website:** a link on company website to a survey often used to gather feedback on website or web-based interaction.

**3. Post-transaction surveys**

Post-transaction surveys are conducted immediately after a customer service interaction and usually provide feedback directly on that interaction.

**4. Report (feedback) cards:**

Report cards, like comment cards are physical, paper cards or forms with one or more survey questions designed to collect customer feedback.

**5. Focus groups**

Focus groups are moderated, small group discussions where a pre-selected group of individual (often customers) provides insight into their preferences, attitudes and opinions about products or services.

**6. Social media**

Social media such social networks, online communities, blogs, forums or discussions boards, can be used to collect customer feedback.

**7. Toll free telephone numbers**

Toll free telephone numbers are an effective tool for receiveing customer feedback/compliant.

**8. Customer visits**

Visits to customer place of business is an another technique for gathering information and feedback of the product.

**9. Employee feedback**

Employee feedback is also potential source of information.

**7. Explain the various types of costs contributing to the cost of quality. Give examples for each.(May/June 2012)**

**Definition:** Quality costs are defined as those costs associated with the non-achievement of product/service quality as defined by the requirements established by the organization and its contracts with customers and society.

Quality cost is the cost of poor products or services.

**Example of quality costs:**

Retesting computer chip that was tested incorrectly

**Elements of Quality costs:**

The American Society for Quality Control (ASQC) divides quality costs into four categories:

1. Costs of prevention
2. Costs of appraisal
3. Costs of internal failure
4. Costs of external failure

**1.Costs of prevention:**

Prevention costs are the costs that occur when a company is performing activities designed to prevent quality problems from arising in products or services.

Prevention costs relate to efforts to prevent failures. It includes:

- Cost of quality planning: It includes the costs associated with creating an overall quality plan ,cost of market research and product ,inspection plan ,reliability plan.
- Cost of documenting: It includes cost of preparation of required documents such as manuals, procedures, policies etc.
- Process control cost: It the cost associated with implementing the quality plans and procedures to achieve the stand purpose.
- Cost of training: It includes the costs of conducting training programmes
- Costs associated with preventing recurring defects: It is the engineering,technical and supervisory costs for preventing the reoccurring defects.
- Costs of investigation ,analysis and correction of causes of defects by quality control and engineering departments.

## 2. Costs of appraisal

Appraisal cost associated with measuring, evaluating or auditing products or service to ensure that they conform to specifications or requirements. Appraisal costs relate to testing, execution and examination to assess whether specified quality is being maintained.

It includes:

- Cost of receiving test and inspection
- Cost of laboratory acceptance testing
- Cost of installation testing
- Cost of installation and commissioning
- Cost of analysis of reporting of tests and inspection results.
- Cost of line quality engineering
- Cost of vendor rejects.

## 3. Costs of internal failure:

Internal failure costs arise due to internal failures. These costs are linked to correcting mistakes before delivery of the products, such as: scrap, rework, remaking, reinsertion, retesting and also sales discounts for inferior products. Internal failure costs are costs associated with product non-conformities (service failures) found before the product is shipped to the customer.

It includes:

- Cost associated with scrap and rejects
- Cost of repair and rework
- Cost of design changes
- Cost of trouble – shooting or defect failure analysis
- Cost of re-inspection and retesting
- Cost of sales discounts for inferior products.
- Cost of downgrading
- Cost of downtime.

## 4. Costs of external failure

External failure costs arise from the rejection of products and service by the customer due to poor quality. The external failure costs are tests that occur when non-conforming product or services reaches the customer. These costs are associated with the adjustments of malfunctions after delivery of the product, such as: repair costs, travel and

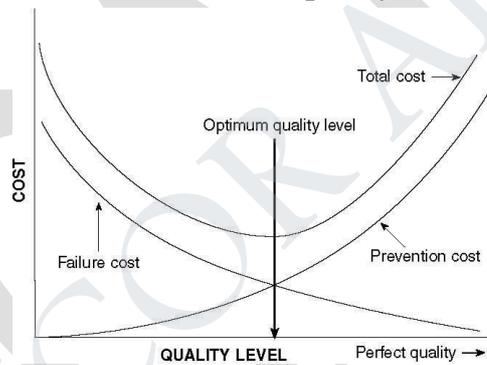
lodging expenses, replacement costs, stock spare parts etc.

It includes:

- Cost of processing complaints from customers
- costs of commissioning failures
- Cost of servicing or replacing the defective items
- Cost of guarantee and warranty claims
- Cost of lost goodwill of customer
- Cost of product reliability compensation
- Cost of loss of sales

**Hidden costs**, also known as the intangible costs, are the costs associated with providing a non-conforming product or service to a customer that are difficult to identify and quantify.

**Optimum Quality costs (Economic model for quality costs)**



The model shows the curves:

- Cost of internal and external failures curves:** These costs are equal to zero when the product is 100 % good and equal to infinity when the product is 100 % defective
- Costs of appraisal plus prevention curve:** These costs are equal to zero when the product is 100% defective and rise as perfection is approached.

**UNIT II**  
**TQM PRINCIPLES**  
**PART A**

**1. What do you mean by strategic planning? (NOV/DEC 2015)**

Strategic planning sets the long-term direction of the organization in which it wants to proceed in future.

**2. What is meant by reactive and proactive behavior?**

**Proactive behavior:** According to behavioural theory of motivation, people would get motivated to work for recognition and reward. They have a like for work

**Reactive behavior:** Some people have a dislike for work. Punishment only motivate the people

**3. What are the conditions necessary for empowerment?**

- Everyone must understand the need for change
- The system needs to change to the new paradigm
- The organization must provide information, education and skill to its employees.

**4. List four common barriers to team progress. (Nov/Dec 2011) (Nov/Dec 2010)**

Insufficient training, incompatible rewards and compensation, lack of planning and lack of management support.

**5. What is performance appraisal and what is the use of performance appraisal? (May/June 2006)**

Performance appraisal is a systematic and objective assessment or evaluation of performance and contribution of an individual.

**Uses:**

- To identify employees for salary revision, promotion, transfer, demotion and lay-off
- To provide useful feedback to the employees and allow them to take corrective measures to improve performance further.

**6. What is 5S's and list its benefits. (May/June 2012) (Nov/Dec 2013)**

The 5S practice is a house keeping technique used to establish and maintain a productive and quality environment in an organization.

SEIRI, SEITON, SEISO, SEIKETSU and SHITSUKE

**Benefits:**

- Work place become clean and better organized

- Results in good company image and generates more business
- Shop floor and office operations become easier and safer.
- Contribute to productivity ,quality and employee morale

**7. Explain supplier selection.(Nov/Dec 2008)**

Suppliers are selected based on their performance in terms of cost, quality and delivery reliability

**8. List the characteristics of successful quality leaders.(May/June 2013)**

- The customers first
- Value people
- Build supplier partnership
- Empower people
- Demonstrate involvement/commitment
- Strive for excellence
- Explain and deploy policy
- Improve communication
- Promote teamwork
- Benchmark continuously
- Establish system
- Encourage collaboration

**9. List out any four benefits of employee involvement.**

- Employee involvement is the backbone of a TQM movement
- An effective TQM effort requires the total involvement from person at all levels in the organization
- Employee involvement leads to meet the organization goals and objectives
- It also improves the quality and productivity at all levels of the organization.

**10. What are the important habits of quality leader? (Nov/Dec 2011)  
What are the traits of successful leaders? (NOV/DEC 2015)**

Be proactive, Begin with the end in mind, Put first things first, Think win/win, seek first to understand..Then to be understood, synergies, sharpen the saw

**11. What do you understand by “supplier rating”?(May/June 2015) (NOV/DEC 2016)**

A supplier rating system, also referred as a scorecard system, is used to obtain an overall rating of supplier performance.

**12. List the benefits of team work.( May/June 2015) (May/June 2017)**

Teamwork is the cumulative action of the team during which each member of the team subordinates his individual interest and opinions to fulfill the objectives or goals of the group

- Enhanced performance
- Employee benefits
- Reduced costs
- Organization enhancements
- Increase reliability
- Increase productivity
- Employee loyalty

**13.What is supplier partnering? ( Nov/Dec 2014)(MAY/JUNE2013)**

Supplier partnering is defined as a continuing relationship, between a buying firm and supplying firm, involving a commitment over an extended time period, an exchange of information and acknowledgement of risks and rewards of the relationship

**14. What is meant by customer retention? ( Nov/Dec 2014)**

Customer retention is the most difficult job an organization is to undertake. Any organization can not dispense with this, because it is the root of business improvement. Customer retention is more powerful and effective than customer satisfaction. Customer satisfaction surveys , interviews with customers and quick redressal of their grievance must be undertaken as important activities by any organization. In fact customer retention is the connection between customer satisfaction and the so called bottom line.

**15. List the key elements of supplier partnering.(MAY/JUN 2013)**

The three key elements for partnering partnering are

1. Long term commitment
2. Trust
3. Shared Vision

**16. How employee involvement can be improved in an organization?  
(NOV/DEC 2016)**

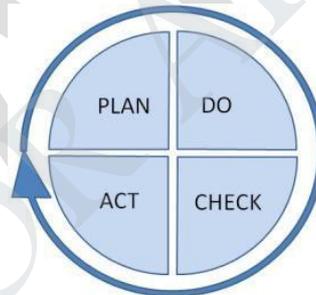
Recognition is a form of employee motivation in which the organization openly acknowledges the positive contribution an individual or team has made to the success of the organization. It may be either in oral or writing praising the deserving

employee by presenting certificates or members .they may also be rewarded by cash awards. Reward is something tangible such as cash award to promote desirable behaviour. Reward can be delayed but recognition cannot be delayed & should be on a timely basis.

**PART B**

- 1. Explain the phases of PDSA cycle with suitable illustration (Nov/Dec 2013) (May/June 2013) (Nov/Dec 2012) (Nov/Dec 2010) (Nov/Dec 2011) (NOV/DEC 2016)**

PDCA is otherwise known as Deming Cycle or Deming Wheel. It is an effective continuous improvement technique. Deming encouraged a systematic approach to problem solving and promoted the widely known Plan, Do, Check, Act(PDCA) cycle. The PDCA cycle is also known as Deming cycle or Deming wheel.



PLAN	What is needed
DO	It
CHECK	That it works
ACT	To correct problems or improve performance

It can be used to test ideas for improvement quickly and easily based on existing ideas, research, feedback, theory, review audit etc..

It encourages starting with small changes, which can build into large improvements in the service through successive quick cycles of change.

It is a universal improvement methodology ,the idea is to constantly improve and thereby reduce the difference between the requirements of the customer and the performance of the process

**Phases of PDSA cycle:**

Phases	Description
<b>Plan</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Define the problem</li> <li><input type="checkbox"/> Analysis the causes and draft an action plan for solving the problem</li> <li><input type="checkbox"/> Determine the quality objectives and the critical factors</li> <li><input type="checkbox"/> Define the performance indicators</li> <li><input type="checkbox"/> Collect and analyze the necessary process data.</li> <li><input type="checkbox"/> Generate possible solutions</li> <li><input type="checkbox"/> Select the most feasible solution and work it out.</li> </ul>
<b>Do</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> First implement the plan on a limited scale or conduct an experiment to test the proposed improvement. Collection of data is essential</li> <li><input type="checkbox"/> Train all involved employees in the use of quality improvement methods and techniques</li> <li><input type="checkbox"/> Describe the process which is considered in the use of quality improvement methods and techniques</li> </ul>
<b>Check</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Evaluate the trail project with the performance indicators</li> <li><input type="checkbox"/> Verify whether the improvement has been successful or not</li> </ul>
<b>Act</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Act to implement proven improvements. The choices are; introduce the plan, adjust or reject it</li> <li><input type="checkbox"/> The improvements are documented in standard procedures so all employees are well-informed on how to handle the feature.</li> </ul>

## **BENEFITS OF PDSA CYCLE**

- Daily routine management for the individual and or the team
- Problem solving process
- Project management
- Continuous development
- Vendor development
- Human resource management
- New product development
- Process trials

## **2.What is meant by strategic planning? Narrate the seven steps procedure of strategic planning cycle. (May/June 2013)(NOV/DEC 2016)**

Strategic planning can be defined as the process of deciding on objectives of the organization, on the resource used to attain these objectives and on the policies that are to govern the acquisition, use and disposition of these resources.

### **Seven steps procedure of strategic planning cycle:**

#### **Step 1: Identification of customer needs**

The basic steps are the Identification of customer needs and their wants. An organization must seek its customer's requirements, expectations and assess future trends before developing a strategic plan

#### **Step 2: Determination of customer positioning**

The second requires the planners to determine its positioning with regards to its customers. Various alternatives such as whether the organization should give up, maintain or expand market position should be considered. In order to become successful, the organization should concentrate and consolidate its position in its areas of excellence.

#### **Step 3: Predict the future**

The planners must predict future conditions that will affect their product or service. To help predicting the future, the tools such as demographics, economic forecasts, and technical assessments or projections may be used.

#### **Step 4: Gap analysis**

The planners must identify the gaps between the current state and the future state of the organization. This is also known as value stream mapping. for identifying the gaps, an

analysis of the core values and concepts and other techniques.

**Step 5: Closing the gap**

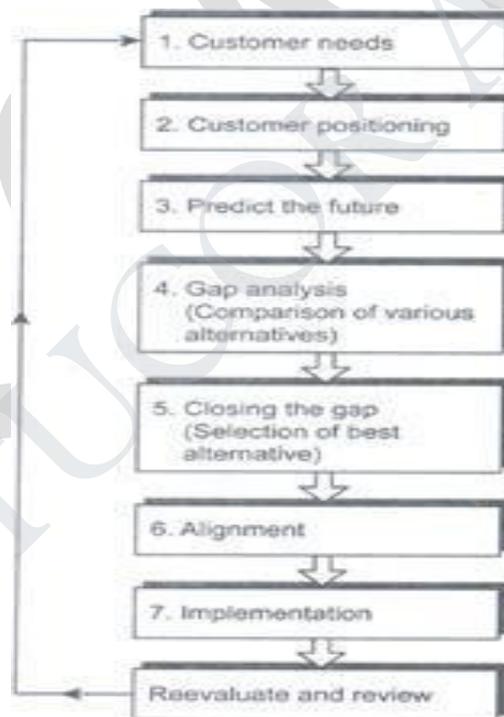
Now the planners should develop a specific plan to close the plan. This is also termed as process improvement. By assessing the relative importance and relative difficulty of each gap, planners can close the gap.

**Step 6: Align the plan with the mission and vision**

Now the revised plan should be aligned with the mission and vision and core values and concepts of the organization. Organization should embrace quality as an essential ingredient in their vision, mission and objectives.

**Step 7: Implementation of the plan**

In order to implement the action plan, resources must be allocated to collecting data, designing changes and overcoming resistance to change. Also the planners should monitor and assess the result of the strategic plan.



**3(a). What is a team? Describe the characteristics of a successful team (Nov/Dec 2013)(May/June 2014)( Nov/Dec 2014) (May/June 2013)/( Nov/Dec 2012)**

A team can be defined as a group of people working together to achieve common objectives or goals Team work is the cumulative actions of the team during which each member of the team subordinates his individual interest and opinions for the fulfilling of objectives of the group.

## CHARACTERISTICS OF SUCCESSFUL TEAMS

1. **Sponsor:** In order to have effective liaison with quality council, there should be sponsor. The sponsor is a person from the quality council; he is to provide support to the organization
2. **Team Charter:** A team charter is a document that defines the team's mission boundaries, the background of the problem, the team's authority and duties and resources. It also identifies the members and their assigned roles – leader, recorder, time keeper and facilitator.
3. **Team Composition:** Not exceeding 10 members except natural work team and self managed teams. Teams should be diverse by having members with different skills, perspectives and potential
4. **Training:** The team members should be trained in the problem solving techniques team dynamics and communication skills
5. **Ground Rules:** The team should have separate rules of operation and conduct. Ground rules should be discussed with the members, whenever needed it should be reviewed and revised
6. **Clear objectives :**The objective of the team should be stated clearly. Without the clear objective, the team functions are not to be effective.
7. **Accountability:** Periodic status report should be submitted to quality council for review.
8. **Well defined decision procedure:** The decision should be made clearly at the right time by the team.
9. **Resources:** Adequate information should be provided to the team whenever needed.
10. **Trust by the management:** Management must trust the team to perform the task effectively. They must trust the members and belief each other.
11. **Effective problems solving:** Problems solving methods is used to make effective decisions.
12. **Open communication:** Open communication should be encouraged ie, everyone feels free to speak in the team whatever they are thinking , without any interruptions.
13. **Appropriate Leadership:** Leader is important in every team. Leader is a person who leads the team, motivate the team and guides the team in a proper direction.
14. **Balanced participation:** Everyone in the team should involve in team activities by voicing their opinions, lending their knowledge and encouraging other members to take part.
15. **Cohesiveness:** Members should be comfortable in working with each other and act as a single unit, not as individuals or group.

### **3(b). Discuss different types of team and stages of team development**

#### **TYPES OF TEAMS**

**Process improvement team:** Involved in improvement of sub processes or processes. Usually has 6-10 members. Disbanded when the objective is reached. May include the local supplied and customer depending on the location

**Cross functional teams:** 6-10 members temporary team. Members are Top management level from various functional areas of management. Discuss complex problems and break down into smaller parts to refer it to various departmental teams for further solution.

**Natural work teams:** Not voluntary and the total work unit is part of the team. Manager also a part of the team and the management selects the projects to be improved. Managers must also ensure that the entire team is comfortable with each other.

**Self directed / self managed work team:** Extension of natural work teams but here the group of individuals is empowered not only to do work but manage it. No manager will present but a coordinator (Which will be normally rotated among members) will be appointed.

#### **STAGES OF TEAM DEVELOPMENT**

- **Forming stage-** Initial stage with only group of individuals and no team work. Team purpose, roles are created.
- **Storming Stage** -Initial agreement roles are challenged. Hostilities, emerge which may be resolved
- **Norming Stage**-Formal informal relations get established.
- **Performing Stage** -Team operates in a successful manner with trust, openness, healthy conflict and decisiveness among the members.
- **Maintenance stage** – Functioning should not deteriorate with time Evaluating Stage – Evaluating team performance

**4.What is 5S?Explain all the elements of 5S principle in detail(nov/dec 2010)  
(japanese 5-s practice)**

This is a house keeping technique used to establish and maintain a productive and quality environment in an organization. This method is invented in Japan which will give safer, more efficient and more productive operation results in boosting the morale of workers, job involvement and satisfaction and ownership of their responsibilities.

<b>Japanese Term</b>	<b>English Equivalent</b>	<b>Meaning</b>
SEIRI	Sorting out	Cleaning – Throw away all rubbish unrelated materials in the work place
SEITON	Systematic arrangement(Straighten)	Arranging – Set everything in proper place for quick retrieval and storage
SEISO	Spic and span(scrub ,shrine, sweep)	Sweeping – Clean the work place, every thing with out fail
SEIKETSU	Standardizing	Maintaining Cleanliness – Standardizing the way of maintaining cleanliness
SHISUKE	Self-discipline(sustain)	Self Discipline – Practice 5S,, daily. Make it a way or life. This also means commitment

**OBJECTIVES OF 5S**

- Create a neat and clean work place

- Create systemize day to day working
- Improve work efficiency
- Standardize work practice
- Improve work discipline
- Improve the quality of work and products

### **SEIRI: SORTING**

It denotes to identify and sort out all items into necessary and unnecessary items and discard all unnecessary items.

### **SEITON: SYSTEMATIZE**

It means to arrange everything in proper order so that it can be easily picked up for use. A place for everything and everything in its place.

### **SEISO: SHINE**

It means to clean the workplace thoroughly so that there is no dust/dirt/scrap anywhere.

### **SEIKETSU: STANDARDISE**

It means maintaining a high standard of workplace organization and house keepinh at all times.

### **SHISUKESELF-DISCIPLINE**

- It denotes self-discipline ,especially with regard to safety rules and punctuality
- 5S means everything in its place. People must also be in their place, at the right time, in the right attire.
- It is management duty to train people to practice 5S with discipline ,to acquire the habit and to keep it.

### **BENEFITS IN IMPLEMENTING 5S**

- Work place becomes proud place to work
- Results in good image and- generates business
- Operations become easier and safer in work place
- Disciplined people

**5. What are seven habits of highly effective people? Discuss in detail. (May/June 2014)**

**Habit 1: Be Proactive**

Being proactive means taking responsibility for your life--the ability to choose the response to situation. You can't keep blaming everything on your parents or grandparents.

**Proactive people** recognize that they are "response-able." They don't blame genetics, circumstances, conditions, or conditioning for their behavior. They know they choose their behavior.

**Reactive people**, on the other hand, are often affected by their physical environment. They find external sources to blame for their behavior. If the weather is good, they feel good. If it isn't, it affects their attitude and performance, and they blame the weather. All of these external forces act as stimuli that we respond to.

**A proactive person uses proactive language**--I can, I will, I prefer, etc.

**A reactive person uses reactive language**--I can't, I have to, if only.

- Reactive people believe they are not responsible for what they say and do--they have no choice.
- Instead of reacting to or worrying about conditions over which they have little or no control, proactive people focus their time and energy on things they can control. The problems, challenges, and opportunities we face fall into two areas-- Circle of Concern and Circle of Influence.
- Proactive people focus their efforts on their Circle of Influence. They work on the things they can do something about: health, children, problems at work. Reactive people focus their efforts in the Circle of Concern--things over which they have little or no control: the national debt, terrorism, the weather. Gaining an awareness of the areas in which we expend our energies in is a giant step in becoming proactive.

**Habit 2: Begin with the End In Mind**

- Habit 2 is based on imagination--the ability to envision in your mind what you cannot at present see with your eyes.
- It is based on the principle that all things are created twice. There is a mental (first) creation, and a physical (second) creation.

- The physical creation follows the mental, just as a building follows a blueprint. If you don't make a conscious effort to visualize who you are and what you want in life, then you empower other people and circumstances to shape you and your life by default.
- It's about connecting again with your own uniqueness and then defining the personal, moral, and ethical guidelines within which you can most happily express and fulfill yourself.
- Begin with the End in Mind means to begin each day, task, or project with a clear vision of your desired direction and destination, and then continue by flexing your proactive muscles to make things happen.

### Habit 3: Put First Things First

Habit 1 says, "You're in charge. You're the creator." Being proactive is about choice. Habit 2 is the first, or mental, creation. Beginning with the End in Mind is about vision. Habit 3 is the second creation, the physical creation. This habit is where Habits 1 and 2 come together. It happens day in and day out, moment-by-moment. It deals with many of the questions addressed in the field of time management. But that's not all it's about. Habit 3 is about life management as well--your purpose, values, roles, and priorities

	Urgent	Not Urgent
Important	<b>1. Necessity - Reduce</b> Tasks that need your immediate attention. Reactive 'fire-fighting'	<b>2. Quality - Increase</b> Habitual, proactive actions that reduce quadrant 1.
Not Important	<b>3. Deception - Manage</b> Things that <i>appear</i> to be worth doing.	<b>4. Waste - Avoid</b> Time wasting activities

### Habit 4: Think Win-Win

- Win –Win is a frame of mind and heart that constantly seeks mutual benefit in all human interactions. Both sides come out ahead; in fact the end result is usually a better way. If Win-win is not possible, and then the alternative is no deal. It takes great courage as well as consideration to create mutual benefits, especially if the other party is thinking Win-Lose.

- Win-Win embraces five independent dimensions of life-character, relationships, agreements, systems and processes. Character involves: integrity and maturity which is a balance between being considerate of others and the courage to express feelings.

### **Habit 5: Seek First To Understand, Then To Be Understood**

- Empathic Listening is the key to effective communication. It focuses on listening how the other person sees the world. Empathic Listening is not that you agree with someone; it's that you fully, deeply understand that person, emotionally as well as intellectually.
- The second of the habit is to be understood. Covey uses three sequentially arranged Greek word: Ethos, pathos and logos. Ethos is your personal character, pathos is the empathy you have with the other person's communication and logos is the logic or reasoning part of your presentation.

### **Habit 6: Synergize**

Synergy means whole is greater than the parts. To put it simply, synergy means "two heads are better than one." Synergize is the habit of creative cooperation. It is teamwork, open-mindedness, and the adventure of finding new solutions to old problems. But it doesn't just happen on its own. It's a process, and through that process, people bring all their personal experience and expertise to the table. Together, they can produce far better results that they could individually. Synergy lets us discover jointly things we are much less likely to discover by ourselves.

### **Habit 7: Sharpen the Saw**

**Habit 7 is taking time to sharpen the saw so it will cut faster.**

Sharpen the Saw means preserving and enhancing the greatest asset you have-- you. It means having a balanced program for self-renewal in the four areas of your life: physical, social/emotional, mental, and spiritual. Here are some examples of activities:

<b>Physical:</b>	Beneficial eating, exercising, and resting
<b>Social/Emotional:</b>	Making social and meaningful connections with others
<b>Mental:</b>	Learning, reading, writing, and teaching
<b>Spiritual:</b>	Spending time in nature, expanding spiritual self through meditation, music, art, prayer, or service

**6.a .Briefly explain employee motivation with its theories (nov/dec 2009)**

**Employee motivation**

- Motivation means a process of stimulating people to accomplish desired goals.
- Motivation is the process of attempting to influence others to do your will through the possibility of reward.

**Importance of motivation**

- Motivation improves employee involvement
- Motivation promotes job satisfaction and thus reduce absenteeism and turnover
- Motivation helps in securing high level of performance and hence enhance efficiency and productivity.

**Theories of motivation:**

**a)Maslow's need hierarchy theory**

One of the most widely mentioned theories of motivation is the hierarchy of needs theory put forth by psychologist Abraham Maslow. Maslow saw human needs in the form of a hierarchy, ascending from the lowest to the highest, and he concluded that when one set of needs is satisfied, this kind of need ceases to be a motivator.

As per his theory these needs are:

**(i) Physiological needs:**

These are important needs for sustaining the human life. Food, water, warmth, shelter, sleep, medicine and education are the basic physiological needs which fall in the primary list of need satisfaction. Maslow was of an opinion that until these needs were satisfied to a degree to maintain life, no other motivating factors can work.

**(ii) Security or Safety needs:**

These are the needs to be free of physical danger (fire,accident) and of the fear of losing a job, property, food or shelter. It also includes protection against any emotional harm.

**(iii) Social needs:**

Since people are social beings, they need to belong and be accepted by others. People try to satisfy their need for affection, acceptance and friendship.

**(iv) Esteem needs:**

According to Maslow, once people begin to satisfy their need to belong, they tend to want to be held in esteem both by themselves and by others. This kind of need produces such satisfaction as power, prestige status and self-confidence. It includes both internal esteem factors like self-respect, autonomy and achievements and external esteem factors such as states, recognition and attention.

**(v) Need for self-actualization:**

Maslow regards this as the highest need in his hierarchy. It is the drive to become what one is capable of becoming; it includes growth, achieving one's potential and self-fulfillment. It is to maximize one's potential and to accomplish something.

**b) Herzberg's motivation-hygiene theory:**

Herzberg's studies concentrated on satisfaction at work. 200 engineers and accountants were asked to recall when they had experienced satisfactory and unsatisfactory feelings about their jobs.

Common motivators or satisfiers

- Achievement
- Recognition
- Advancement
- Personal growth
- The work it self
- Challenging work

Common dissatisfies:

- Salary
- Working conditions
- Company policy and administration
- Job security
- Status
- Interpersonal relationship

According to Herzberg's, maintenance or hygiene factors are necessary to maintain a reasonable level of satisfaction among employees. These factors do not provide satisfaction among employees but their absence will dissatisfy them. Therefore these factors are called dissatisfies.

Motivational factors create satisfaction to the workers at the presence but their absence does not cause dissatisfaction.

**6.b. Portray the characteristics of empowered employees. (NOV/DEC 2016)**

Empowerment is an environment in which people have the ability, the confidence and the commitment to take the responsibility and ownership to improve the process and initiate the necessary steps to satisfy customer requirements within well defined boundaries in order to achieve organizational values and goals.

The word empowerment is not to be confused with delegation or job enrichment. Delegation is distribution and entrusting work to others. Employee empowerment requires the individual to be held responsible for accomplishing a whole task. Besides the employee by having been empowered becomes accountable for the work. The following conditions are necessary for employee empowerment.

1. Everyone must understand the need for the change.
2. The system needs to change to create a new scenario.
3. The organization must enable its employees.

People fear change that is why they resist change. Change is always considered as something imposed on them without their full concern. The organization needs an effective communication with their employees. They should be convinced that the change would benefit them. Change in the system is a must to reinforce and motivate the individual and group accomplishment. Enabling the employees means providing information, education and skill. People normally want to be more in charge of their jobs and careers. Many appreciate the value of trust and responsibility in an environment supporting people and their actions.

**7. What is supplier partnering? Indicate its important benefits. (NOV/DEC 2016) (MAY/JUN 2013)**

Successful supplier partnerships require commitment and continual nurturing. The following points are mandatory requirements of supplier partnerships;

- Ø Supplier personnel should meet with buyer personnel beyond those in the purchasing office. It is particularly important for them to meet with personnel who actually use their products so that needed improvements can be identified and made.

- Ø The price-only approach to buyer –supplier negotiations should be eliminated. Product features, quality, and delivery concerns should also be part of the negotiations. The goal of the negotiations should be to achieve the optimum deal when price, feature, quality, and delivery issues are all factored in.
- Ø The quality of supplier products should be guaranteed by the supplier’s quality processes. The buyer should have no need to inspect the supplier’s products.
- Ø Both partners should be capable of sharing information electronically so that the relationship is not inhibited by paperwork. Electronic data exchange is particularly important for successful Just in Time (JIT).
- Ø The supplier should fully understand and be able to practice just-in time (JIT). Buyers should not need to maintain inventories.

## **ROLE OF SUPPLIER PARTNERSHIP**

### **1. Timeliness**

The suppliers should ensure that they deliver the required inputs on time while in return the customer (organization) should pay for the supplied inputs on time hence saving time and creating a good relationship.

### **2. Information**

The customer (organization) is responsible for providing the supplier with clear and sufficient information of requirements so that the supplier can know precisely what to produce. Both the customer and the supplier should continually exchange information, sometimes using multifunctional teams, in order to improve the product and service quality.

### **3. Product evaluation**

Both the customer (organization) and the supplier should decide the method to evaluate the quality of the products or services to the satisfaction of both parties. This will enhance their relationship which may lead to better provision of services to organization’s customers.

### **4. Monitor customer complaints**

When dealing with business transactions, both the customer and the supplier should always have the best interest of the end user in mind. Having a complaints handling system in place will help you pick up on any adverse incidents and trends relating to your products. For example, the Australian Standard AS/ISO 10002:2006 *Customer Satisfaction—Guidelines for complaints handling in organizations* provides advice on the complaints handling process, including planning, design, operation, maintenance and improvement.

### **5. Awareness of product liability laws**

Both customer and supplier should ensure that their products comply with the safety standards. If end user suffer serious injury or death from problems with your products, you and your business could be liable under the product liability provisions of the Consumer Law or at common law.

### **6. Ensure necessary tests are done**

Many products need testing to ensure they are safe and free of faults and consistently meet any mandatory standards that apply. If you are supplying products covered by mandatory standards or bans, every item must comply. If you claim that all your goods comply, you must be able to support this with evidence. Having an effective compliance program helps you to gather this evidence.

### **7. Provide dependable products**

In supplier partnership it's the role of the supplier to ensure the quality and reliability of the products they supply. The supplier must be reliable at all time. The quality of the products should not be compromised hence quality improvement.

### **8. Anticipate changing needs and acting on them**

The customer (Organization) should be aware of changing needs of the end user and therefore adjust accordingly. On the other hand, the supplier should adjust according the needs of the consumer.

### **9. Commitment**

Long-term commitment to the partnership provides the needed environment for both parties to work towards continuous satisfaction of end users needs. Each party contributes its unique strengths to the process hence product quality improvement.

### **10. Compliance with mandatory standards**

Any products subject to mandatory product safety regulations must comply before you can sell them. Mandatory standards and bans are law. For instance, In Kenya the products should bear the Diamond Standardization mark of Quality from Kenya Bureau of Standards (KEBS).

### **11. Communication**

Any arising needs in product by the management should be communicated to the supplier on time. This will ensure that no delays are experienced on both parties which could lead to inefficiencies and delays in production therefore compromising quality. Suppliers that do not maintain a policy of open communication- or even worse, actively practice deception- should be avoided at all costs.

## **12. Plan ahead for recalls**

A company that has a set of recall roles and procedures in place will save time and money, and will help protect their reputation, in the event that a recall is necessary. It is in everybody's interests to act quickly and surely to remove unsafe products as soon as they have been found.

**UNIT III**  
**TQM TOOLS AND TECHNIQUES I**  
**PART A**

**1. Why is brainstorming considered as an effective tool? (May/June 2014)**

Brainstorming is a technique used to gather multiple ideas about the given problem. Hence we can arrive on the optimal solution, from the various alternatives.

**2. What is a prioritization matrix? (Nov/Dec 2014)**

A Six Sigma Tool called a Prioritization Matrix helps you in narrowing down the activities or projects by identifying a beneficial order of getting the most important things done first. It works on assignments and projects whose relative importance is not yet known. It is used in situations where you have access to limited resources like money, time, and people (employees).

**3. What is scatter diagram? (Nov/Dec 2014)**

The scatter diagram is a simple graphical device to depict the relationship between two variables.

**Uses:**

- The purpose of the scatter diagram is to display what happens to one variable when another variable is changed.
- This diagram is used to understand why particular variations occur and how they can be controlled.

**4. What are the factors that distinguish six sigma concepts from traditional quality management concepts? (Nov / Dec 2013)**

The six sigma is nothing but an extension of the control limits from  $\pm 3\sigma$  limit to the  $\pm 6\sigma$  limit. The chance of a part going outside the control limits from  $\pm 3\sigma$  is 27 parts in 1000 and that of  $\pm 6\sigma$  is 3.4 parts per million. This means that the probability of the parts produced going outside the control limit much higher in the  $\pm 3\sigma$  limit system than in the  $\pm 6\sigma$  limit system.

**5. What is meant by Failure Mode and Effect Analysis? (Nov / Dec 2013)**

The objective of FMEA is to anticipate failures and prevent them from occurring. FMEA priorities failures and attempts to eliminate their causes.

**6. What are the types of check sheets commonly used? (May/June 2013)**

1. Process distribution check sheet

2. Defective item check sheet
3. Defect location check sheet
4. Defect factor check sheet

**7. What is benchmarking? Give an example? (May/June 2013)**

Benchmarking is the process of identifying, understanding and adapting outstanding practices and processes from organizations anywhere in the world to an organization to improve its performance.

Example: Toyota production system is considered as a benchmark for the auto industry.

**8. What are the benefits of bench marking?( Nov /Dec 2012)( Nov /Dec 2011)**

1. Creating a culture that values continuous improvement to achieve excellence.
2. Sharing the best practices between benchmarking partners.
3. Prioritizing the areas that need improvement.
4. Enhancing creativity by devaluing the not-invented-here syndrome.

**9. Describe the evolution of six sigma in Motorola company ( Nov /Dec 2012)**

- Six sigma was started by Motorola in 1987, in its manufacturing division; then General Electric (GE) embraced it in 1995 for its product (PPM).
- Six sigma is a systematic method for process and product improvement and for measuring performance variation. It allows only 3.4 defects per million opportunities.

**10. What are benefits of TPM? (May/June 2012)**

1. To improve equipment effectiveness
2. To achieve autonomous maintenance
3. To plan maintenance
4. To train all staff in relevant maintenance skills

**11. What are the problems involved in benchmarking a direct competitor? (May/June 2012)**

- Cannot give a sustained competitive advantage.
- Lead to stagnation of ideas, strategies, best industry practices etc.

**12. What is six sigma? What are the five phases of six sigma process /(Nov/Dec 2010) (May/June 2012)**

Six sigma is similar to Zero Defects (ZD), is a philosophical benchmark or standard of excellence proposed by Philip Crosby. Six sigma strives for perfection. It allows for only 3.4 defects per million opportunities (or 99.99966 percent accuracy)

**Five phases of six sigma process:**

Define, Measure, Analyse, Improve and control

**13. Different ways of bench marking.(NOV/DEC 2016)**

There are four primary ways of benchmarking:

internal, competitive, functional, and generic

**14. How cause and effect diagram is used in TQM? (NOV/DEC 2016)**

An effective tool as part of a problem-solving process is the cause-and-effect diagram, also known as the Ishikawa diagram (after its originator) or fishbone diagram. This technique is useful to trigger ideas and promote a balanced approach in group brainstorming sessions where individuals list the perceived sources (causes) with respect to outcomes (effect).

**PART B**

**1. Explain the New seven tools of quality management (Nov/Dec 2013)**

**(May/June 2013)(Nov/Dec 2012)(Nov/Dec 2014) (May/June 2014)(NOV/DEC 2016)**

The seven basic quality tools are mostly useful for quantitative problems, whereas the new seven management tools are defined for the qualitative problems. These qualitative tools also known as “seven management and planning tools” are helpful for managers:

- (i) To organize large amounts of non-quantitative data
- (ii) To create hypotheses.
- (iii) To clarify inter-relationships
- (iv) to establish priorities

**New Seven Management tools and its purpose:**

- Affinity diagram- For synthesizing, classifying, organizing, indefinite ideas.
- Relationship diagram - For isolating cause-and-effect relationships.
- Tree diagram- For deploying general concepts into details

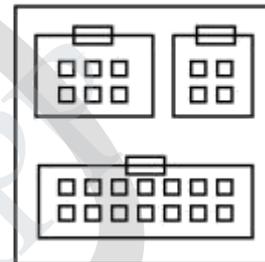
- Matrix diagram- For correlating in a logical form, in order to evaluate, select and decide.
- Matrix data analysis diagram- For qualifying relationships
- Decision tree (PDPC)-For identifying alternatives
- Arrow diagram(PERT)- For planning

### Affinity Diagram

This tool takes large amounts of disorganized data and information and enables one

to organize it into groupings based on natural relationships. It was created in the 1960s by Japanese anthropologist Jiro Kawakita.

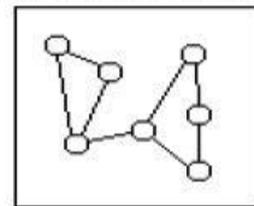
### Affinity Diagram



### Relationship Diagram

This tool displays all the interrelated cause-and-effect relationships and factors involved in a complex problem and describes desired outcomes. The process of creating an interrelationship diagram helps a group analyze the natural links between different aspects of a complex situation.

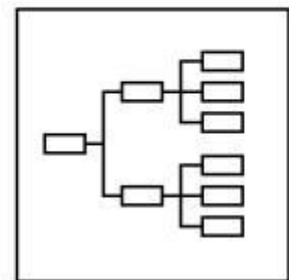
### Interrelationship Diagram



### Tree Diagram

This tool is used to break down broad categories into finer and finer levels of detail. It can map levels of details of tasks that are required to accomplish a goal or task. It can be used to break down broad general subjects into finer and finer levels of detail. Developing the tree diagram helps one move their thinking from generalities to specifics.

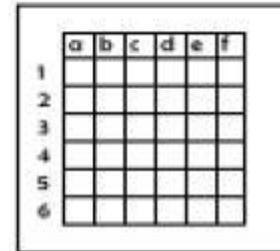
### Tree Diagram



**Prioritization Matrix**

This tool is used to prioritize items and describe them in terms of weighted criteria. It uses a combination of tree and matrix diagramming techniques to do a pair-wise evaluation of items and to narrow down options to the most desired or most effective.

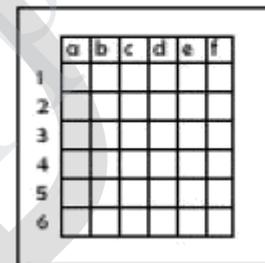
**Prioritization Matrix**



**Matrix Diagram**

This tool shows the relationship between items. At each intersection a relationship is either absent or present. It then gives information about the relationship, such as its strength, the roles played by various individuals or measurements. Six differently shaped matrices are possible: L, T, Y, X, C and roof-shaped, depending on how many groups must be compared.

**Matrix Diagram**



**Process Decision Program Chart (PDPC)**

A useful way of planning is to break down tasks into a hierarchy, using a Tree Diagram. The PDPC extends the tree diagram a couple of levels to identify risks and countermeasures for the bottom level tasks. Different shaped boxes are used to highlight risks and identify possible countermeasures (often shown as 'clouds' to indicate their uncertain nature). The PDPC is similar to the Failure Modes and Effects Analysis (FMEA) in that both identify risks, consequences of failure, and contingency actions; the FMEA also rates relative risk levels for each potential failure point.

**Activity Network Diagram**

This tool is used to plan the appropriate sequence or schedule for a set of tasks and related subtasks. It is used when subtasks must occur in parallel. The diagram enables one to determine the critical path (longest sequence of tasks).

**2.Explain the seven basic tools of quality(seven statistical tools of quality. (May/June 2014) (Nov/Dec 2014)**

**Traditional tools of quality**

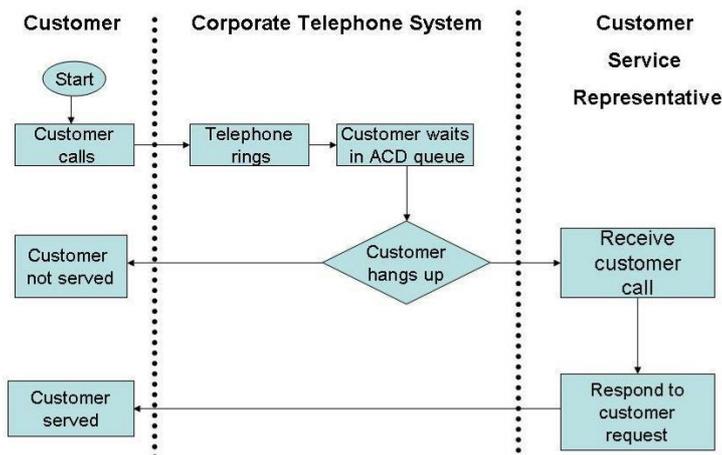
1. Flowcharts
2. Check sheets
3. Histograms
4. Pareto diagrams
5. Cause and effect diagrams
6. Scatter diagrams
7. Control Charts

**a.Flowchart :** A flowchart is a diagrammatic representation that illustrates the sequence of operations to be performed to get the solution of a problem.

**When do we use it?**

- A flow chart is used to document and analyze the connection and sequence of events in a process.

**How do we construct it?**



**b. Check Sheet:**

Check sheet also known as tally sheet, is a form of systematic data gathering and registration to get a clear view of the facts.

**When do we use it?**

A check list is used to indicate the frequency of a certain occurrence.

- How do we construct it?
- Formulate the objective of collecting data.
- Decide which data is necessary
- Determine who and how data is analyzed.
- Draw a format to record data
- Collect and record data problem-wise by putting tally lines.
- Start counting the tallying on the list: I, II, III, IIII and IIII represent the numbers 1,2,3,4 and 5 respectively.

**Types of check sheet:**

1. Process Distribution check sheet
2. Defective item check sheet
3. Defect location check sheet
4. Defect factor check sheet

Complaint Checksheet						
	Mon	Tues	Wed	Thurs	Fri	Total
No. Users	123	110	130	135	128	626
Complaints	IIII IIII IIII II	IIII IIII IIII IIII IIII	IIII IIII IIII IIII IIII IIII	IIII IIII IIII IIII IIII I	IIII IIII IIII IIII IIII III	
No. Complaints	17	20	24	21	23	105
Percent of users complaining	14%	18%	18%	16%	18%	17%

**c. Histogram:**

Histogram is a bar chart/diagram showing a distribution of variable showing quantities or characteristics.

**When do we use it?**

- A histogram is used to show clearly where the most frequently occurring values are

located and the data is distributed.

- It is a tool for measuring maximum process results.

**How do we construct it?**

- After the data collection count the number of values collected
- Determine the range of data. (range value=highest value-lowest value)
- Divide the data values into groups or classes and count the data values in each class.
- Now determine the width of the class.
- Draw the frequency table for a value.
- Construct a histogram based on the frequency table.
- Write the title and number of values in the diagram

**d.Causes and effect:**

The cause and effect(CE) diagram is a graphical-tabular chart to list and analyze the potential causes of a given problem. The causes and effect diagram is also called the **fishbone diagram** because of its appearance and the **ishikawa diagram** after the man who developed it in 1943.

**When do we use it?**

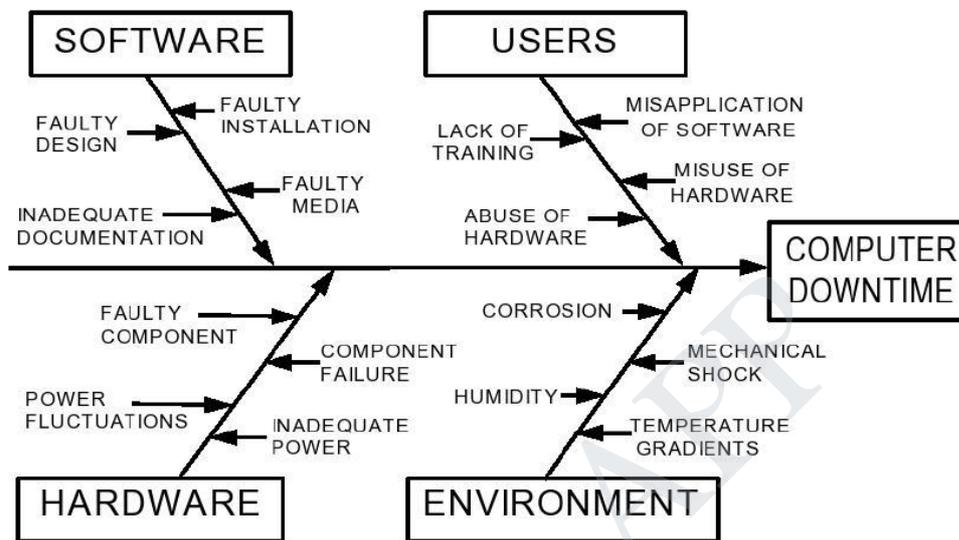
- The CE diagram has unlimited application in research, manufacturing, marketing, office operations ,services and so forth
- To analyze cause and effect relationships
- To facilitate the search for solutions of related problems
- To standardize existing and proposed operations
- To educate and train personnel in decision making and corrective action activities.

**How do we construct it?**

1. Define the effect (problem) clearly and concisely
2. Make the short description of the effect in a box.Then draw a line from this box towards left
3. List down all possible minor and major causes through a brainstorming session
4. Mark the major causes on the branches and minor causes on the sub-branches of CE diagrams.

5. Look for possible solutions for these causes.
6. Introduces the changes.

**Illustrations:**



**e. Pareto Diagram**

**What is it?**

A *Pareto diagram* is a diagnostic tool commonly used for separating the vital few causes that account for a dominant share of quality loss.

- This tool is named after Wilfred Pareto, the Italian economist, who devised this tool first.
- The Pareto diagram is based on the *Pareto Principle*, which states that few of the defects account for most of the effects.
- Pareto analysis is also called as *80/20 rule* and as *ABC analysis*. It means only 20% of problems (defects) account for 80% of the effects.
- This analysis is a method of classifying items, events or activities according to their relative importance.

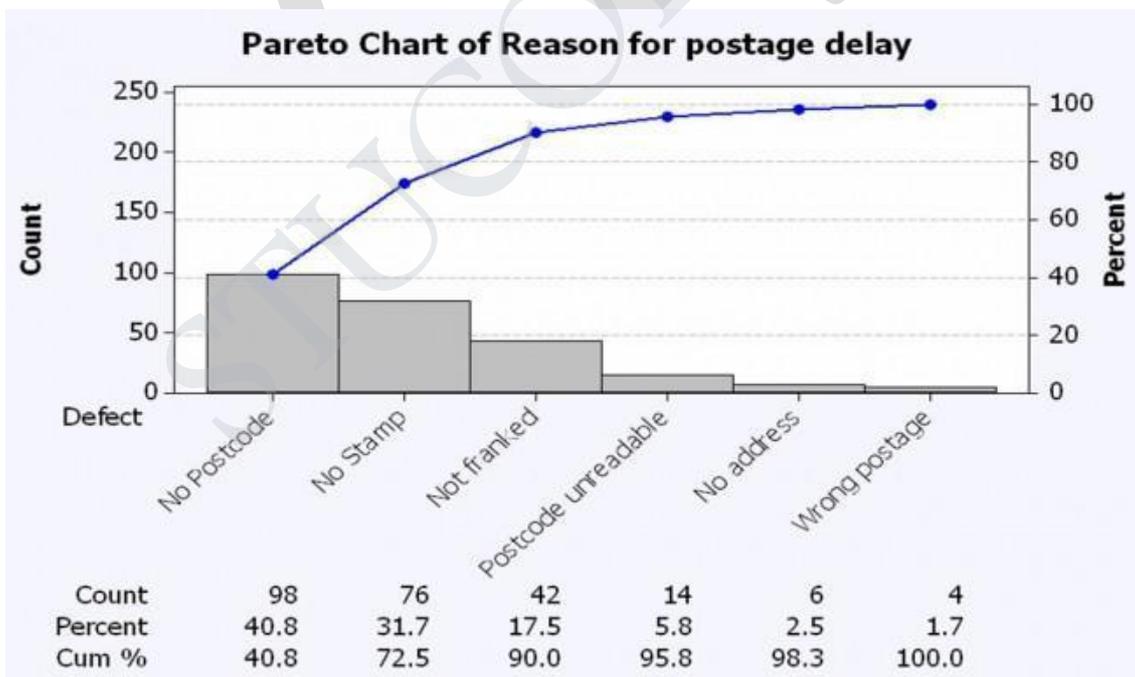
**When do we use it?**

*Pareto analysis* can be used in a wide range of situations where one need to priorities problems based on its relative importance. It can be used as a risk assessment technique from activity level to system level.

**How can we construct it?**

A Pareto diagram can be constructed using the following steps:

- Obtain data, using a check sheet or brainstorm.
- Arrange the data in descending order starting from the largest category to smallest.
- Calculate the total and percentage of the total that each category represents.
- Compute the cumulative percentages.
- Draw a bar chart with two vertical axis, mark the measured values for each cause, starting from zero till the total number of causes. The right vertical axis should have the same height and should go from 0 to 100%. This axis displays the cumulative percentages. List the different kinds of causes along the horizontal axis, from left to right in descending order of frequency or costs.
- Draw a bar above each item whose height represents the number for that cause.
- Plot a cumulative percentage line.
- Now draw a horizontal line from 80% (on the right vertical axis) to the left till the point of intersection with the cumulative line, and then draw a vertical line from this intersection down wards till the horizontal axis. Left from this intersection point are the 20% of causes (the most essential bottlenecks) which causes 30% of the damages.



### f.Scatter Diagram

**What is it?**

*The scatter diagram* is a simple graphical device to depict the relationship between two

variables.

A scatter diagram is composed of a horizontal axis containing the measured values of one variable (independent, i.e., cause ) and a vertical axis, representing the measurements of the variable (dependent, i.e., cause) and a vertical axis, representing the measurements of the variable (dependent, i.e., effect).

- This diagram display the paired data as cloud of points. The density and direction of the cloud indicate how the two variables influence each other.
- Although this diagram cannot prove that one variable causes the other, but they do indicates the existence of a relationship as well as the strength of that relationship.

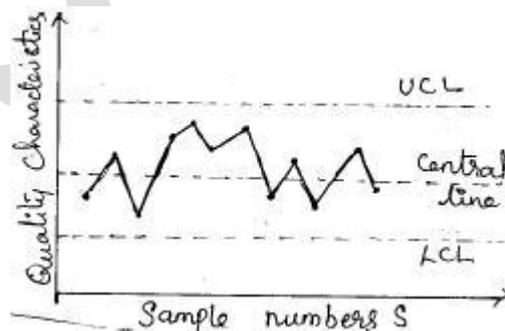
**When do we use it?**

The purpose of the scatter diagram is, therefore, to display what happens to one variable when another variable is changed. This diagram is used to understand, why particular variations occur and how they can be controlled.

**g. Contrl Charts:**

A *control chart*, invented by Walter A. Shewhart, is the most widely used tool in statistical process control (SPC).

- A control chart is a graph that displays data taken over time and the variations of this data.
- A histogram gives a static picture of process variability, whereas a control chart illustrates the dynamic performance (i.e., performance over time) of the process.
- The control chart is based on a series of random samples taken at regular intervals.
- The general form of the control chart is shown in Figure



The chart consists of three horizontal lines that remain constant over time: a center a lower control limit (LCL), and on upper control limit (UCL). The center is usually set at the normal design value. The UCL and LCL are generally set at +3 standard deviations of the sample means.

If a sample drawn from the process lies inside these (UCL and LCL) limits, it means *the process is in control*. On the other hand, if the sample lies outside these limits, then the process is said to be out of control. So appropriate corrective action is necessary to eliminate the condition.

### **Type of Control Charts**

The two basic types of control charts are:

*Control charts for variables\** - for measurable data such as time, length, temperature, weight, pressure, etc.

*Control charts for characteristics\**- for quantifiable data such as number of defects, typing error in a report, etc.

### **When do we use it?**

The purpose of a control is to identify when the process has gone out of statistical control, thus signaling the need for some corrective action to be taken.

**3. Explain the Benchmarking process and its types ?(May/June 2014) (Nov/Dec 2012) (May/June 2013) (May/June 2012) (Nov/Dec 2011) (Nov/Dec 2011)(April/May 2015)**

**What benefits have been achieved by the organizations that have successfully their benchmarking programs. Name any four selected best practiced companies. (NOV/DEC 2016) (May/June 2017)**

"Benchmarking: A continuous, systematic process of evaluating and comparing the capability of one organization with others normally recognized as industry leaders, for insights for optimizing the organizations processes." Benchmarking is the process of comparing the cost, time or quality of what one organization does against what another organization does. The result is often a business case for making changes in order to make improvements. The systematic process of comparing an organizations products, services and practices against those of competitor organizations or other industry leaders to determine what it is they do that allows them to achieve high levels of performance.

### **Reasons for benching marking:**

Benchmarking aims at a goal setting process to facilitate comparison with the best.

- a. It aims at motivating and stimulating company employees towards the goal of continuous quality improvement.
- b. It aims at external orientation of the company.
- c. It aims at identifying a technological breakthrough.

## **Types of Benchmarking.**

Types based on two categories:

- 1. Based on the object to be benchmarked**
- 2. Based on the organizations against whom one is benchmarking**

### **1. Based on the object to be benchmarked**

**Process benchmarking** – comparison of different features and attributes of competing products and services. Also known as “Customer satisfaction benchmarking” or “customer value profiling”.

**Financial benchmarking** - performing a financial analysis and comparing the results in an effort to assess your overall competitiveness.

**Performance benchmarking** - allows the initiator firm to assess their competitive position by comparing products and services with those of target firms. It measures all the different kinds of system performance variables such as efficiency, effectiveness, productivity, quality, flexibility, profitability etc.

**Product benchmarking** - the process of designing new products or upgrades to current ones. This process can sometimes involve reverse engineering which is taking apart competitors products to find strengths and weaknesses.

**Strategic benchmarking** - involves observing how others compete. This refers to examining competitive position in the market place.

**Process benchmarking:** This refers to comparison of processes

**Generic benchmarking:** Comparison of general practices which are common across industry sectors markets.

### **2. Based on the organizations against whom one is benchmarking**

**Internal benchmarking** – Comparison of performance between departments, plants etc within the organisation

**External benchmarking-** comparison of performance with external organization.

**Industry benchmarking-** Comparison with a group larger than the direct competitor

**Competitive benchmarking-**Comparisons of performance with direct competitors

**Best-in-class benchmarking-** Comparison of performance with best practices prevalent in an organization irrespective of product and services.

**Relationship benchmarking**-comparison of performance with the benchmarking company which already has a relationship like customer-supplier relations etc.

**Benchmarking process:**

**Phase I: Planning**

**Step1: Earmark what is to be benchmarked?**

- This step is used to determine which functions, tasks, processes or activities within the organization will be subjected to benchmarking.
- Appoint a benchmarking team that will pilot the activity within the organization.
- In this stage, formulated the project goals; determine the data to be collected and prepare a tentative list of questions.

**Step2: Identify the best competitor**

- Identify the world-class or leading edge companies that have a similar product or process.

**Step3: Determine the data collection method and start collecting data.**

- Gather both qualitative and quantitative data about the process performances of partners based on interviews, surveys and consultation of contacts and technical magazines

**Phase II: Analysis**

**Step 4: Determine the current performance gap**

- Determine the gap between the performance level of the organization and that of its benchmark partner.
- After the data is gathered ,measured and analyzed, compare these to the data of the own organization.

**Step 5: Project future performance levels**

- The gap is the projection of performance. Therefore the performance will change as industry practices change.

**Phase III: Integration**

**Step 6: Communicate benchmark finding and gain acceptance**

Communicate the benchmark findings to all organizational levels to obtain support, commitment and ownership.

**Step 7: Establish functional goals**

On the basis of communicated data and acceptance of analysis, establish the functional goals and achieve them through the benchmarking process.

**Phase IV: Action**

**Step 8: Develop action plans**

Transform the functional goals into concrete action plans.

**Step 9: Implement specific actions and monitor progress**

- This step relates to the execution of improvement actions and introduction of changes
- Constantly monitor the implementation of actions for successful execution.

**Step 10: Recalibrate benchmarks**

- The updating may require the recalibration of the competitive benchmarking data. Since benchmarking is a continuous quality improvement tool, recalibrate the benchmarks again and again

**Phase V: Maturity**

Maturity phase would be reached when best industry practices are incorporated in all business processes. This phase is reached through the following steps

**Step 11: Attain the leadership's position**

**Step 12: Integrate practices into the process**

**Benefits of benchmarking:**

- a. Creating a culture that values continuous improvement to achieve excellence.
- b. Sharing the best practices between benchmarking partners.
- c. Prioritizing the areas that need improvement.
- d. Enhancing creativity by devaluing the not invented here syndrome
- e. Increasing sensitivity to changes in the external environment.
- f. Shifting the corporate mindset from relative complacency to a strong sense of urgency for ongoing improvement.
- g. Focusing resources through performance target set with employee unit.

**4. Define FMEA. Discuss the two types of FMEA. Explain various stages of FMEA (NOV/DEC2016) (May/June 2017)**

Failure mode and effect analysis also known as risk analysis is a preventive measure to systematically display the causes, effects, and possible actions regarding observed failures.

**Objectives of FEMA:**

1. The objective of FEMA is to anticipate failures and prevent them from occurring. FEMA prioritizes failures and attempts to eliminate their causes.
2. FEMA is an engineering technique is used to define, identify and eliminate known and or potential failures, problems, errors which occur in the system, design, process and service before they reach the customer.
3. FEMA is a before the event action and is done when existing systems products processes are changed or redesigned.
4. FEMA is a never ending process improvement tool.

**Types of FEMA:**

1. System FEMA-Analyzes components, subsystem and main system in early stage of design.
2. Design FEMA-Analyzes the products/parts before they are released to manufacturing
3. Process FEMA-Focus on manufacturing and assembly processes.
4. Service FEMA-Analyzes service industry processes before they are released to impact the customer.
5. Equipment FEMA
6. Maintenance FEMA
7. Concept FEMA
8. Environmental FEMA

**Benefits of FEMA:**

1. Improve product/process reliability and quality.
2. Increase customer satisfaction.
3. Early identification and elimination of potential product/process failure modes.
4. Prioritize product or process deficiencies
5. Capture engineering/organization knowledge

**Stages of FEMA:**

The FEMA methodology has four stages: they are:

**Stage1: specifying possibilities**

1. Functions
2. Possible failure modes
3. Root causes
4. Effects
5. Detection/prevention

**Stage 2: quantifying Risk**

1. Probability of cause
2. Severity of effect
3. Effectiveness of control to prevent cause
4. Risk priority number

**Stage3: correcting High risk causes**

1. Prioritizing work
2. Detailing action
3. Assigning action responsibility
4. Check points on completion

**stage4: re-evaluation of risk**

1. Recalculation of risk priority number

**FMEA Procedure:**

Basics steps for implementation of a FMEA are outlined below:

1. Describe the product/process and its function
2. Create a block diagram of the product/process
3. Complete the header of the FMEA form worksheet
4. List product/process functions
5. Identify failure modes

Failure mode is defined as the manner in which component, subsystems, system, process etc. could potentially fail to meet the design purpose

6. Describe the potential failure effects Failure effects are defined as the result of a failure mode on the function of the product/process as perceived by the customer. Eg) injury to the user.
7. Establish a numerical ranking for the severity(S) of the effect.
8. The CLASS column is used to classify any special product characteristics for components, subsystems or systems that may require additional process control.



**5. What is six sigma concept? Develop procedure for implementation of six sigma in a manufacturing organization.(May/June 2013)(May/June 2012)(Nov/Dec 2011)(May/June 2014) (Nov/Dec 2014) (Nov/Dec 2011)(April/May 2015)**

**Six sigma:**

A vision of quality which equates with only 3.4 defects per million opportunities (DPMO) for each product or service transaction and strives for perfection. Six sigma is a systematic method for process and product improvement and for measuring performance variation. It is also a metric for evaluating performance we quality and a standard of excellence (3.4 DPMO)

**Six sigma process:**

DMAIC

Define --> Measure --> Analyze --> Improve --> Control

- Define:** Define the Problem or Project Goal that needs to be addressed.
- Measure:** Measure and determine customers needs and specifications.
- Analyze:** Analyze the process to meet the customer needs.

**Step 1: Define**

Define activities

Identify project, champion and project owner Determine customer requirements and critical to quality Define problem, objective ,goals and benefits

Define stakeholders/resource analysis Map the process

Develop project plan

**Step 2: Measure**

Measure activities:

Determine project critical Xs and Ys.

Determine operational definition

Establish performance standards

Develop data collection and sampling plan

**Step 3: Analyze**

Analyze activities

Benchmark the process or product

Establish casual relationship using data

Analysis of the process map

Determine root cause(s) using data

**Step 4: Improve**

Improve activities

Develop solution alternatives

Assess risks and benefits of solution alternatives Validate solution using a pilot

Implement solution

Determine solution effectiveness using data

**Step 5: Control**

Control activities Determine needed controls

Implement and validate controls

Develop transfer plan Realize benefits of implementing solution Close project and communicate results

**Advantages of six sigma:**

- Improved customer satisfaction
- Ensures products/service meeting customer requirements
- Reduction of waste and defects
- Variation reduction well-defined roles and responsibilities
- Empowering all employees for better improvement.
- Improved communication

**UNIT IV**  
**TQM TOOLS AND TECHNIQUES II**  
**PART A**

**1.What is “Taguchi’s Quality Loss Function”(TQLF) (April/May 2015)(Nov/Dec 2012)**

The essence of taguchi’s quality loss function (QLF) concept is that whenever a product deviates from its target performance, it generates a loss to society. This loss is minimal when performance is right on target, but it grows gradually as one deviates from the target.

**2.Indicate the different parameters used for quality performance measures. (April/May 2015)**

- % increase in quality grade.
- % reduction in failure rate
- % reduction in cost of poor quality
- Reduction in number of customer’s complaints
- % reduction of rejects and scrap
- % reduction of safety and environmental incidents.

**3.What are the big loss avoided by TQM? (May/June 2014)**

- Breakdowns
- Setup and changeover
- Idling and minor stoppages
- Reduced speed
- Defects and rework
- Start up losses.

**4.Define TPM.(Nov/Dec 2013)**

TPM is the systematic execution of maintenance by all employees through small group activities. The dual goals of TPM are zero breakdowns and zero defects.

**5.List the objective of TPM programme.(May/June 2013) (May/June 2017)**

1. To improve equipment effective
2. To achieve autonomous maintenance
3. To plan maintenance
4. To train all staff in relevant maintenance skills

**6.What is meant by “House of quality”? ( May/June 2012) (Nov/Dec 2011)**

The primary planning tool used in QFD is the house of quality(HOQ).The house of quality converts the voice of customer into product design characteristic,QFD uses a series of matrix diagrams ,also called „quality tables“ ,that resemble connected houses.

**7.What is the formula for measuring equipment effectiveness? (Nov/Dec 2011)**

Overall equipment effectiveness (OEE) =availability\*{performance efficiency}\*(rate of quality products}

**8.What is process capability?(May/June 2011) (Nov/Dec 2010)**

Process capability may be defined as the minimum spread, of a specific measurement variation which will include 99.7 % of the measurements from the given process” . Process capability(natural tolerance)=  $6\sigma$

**9.What are the areas in which Quality Function Development is used? (May/June 2011)**

- In the Automobile industry,FORD,Chrysler and General Motors
- In the electronic field,digital Equipment Corporation and Texas instruments

**10.Difference between Taguchi’s approach and traditional approach?(Nov/Dev 2010)**

Traditional approach: The product within the specification limits is considered as a good product while the outside are is considered as bad product.

Taguchi’s approach: When a product moves from its target value, that move causes a loss no matter if the move falls inside or outside the specified limits

**11.What is process capability ratio?(Nov/Dec 2010) (Nov/Dec 2009)**

Process capability index  $C_p = (USL - LSL) / 6\sigma$

Process capability index  $C_{pk} = \min\{(USL - \text{Mean}) \text{ or } (\text{Mean} - USL)\} / 3\sigma$

**12.Write the specific use of np-chart.(NOV/DEC 2016)**

To assess the system’s stability

To determine if you need to stratify the data.

To analyze the results of process improvements.

**13.Define process capability index. (NOV/DEC 2016)**

The potential process capability measures the overall performance of the process and is measured as the ratio of difference between upper specification limit (USL) and

lower specification limit (LSL) to six times of standard deviation ( $\sigma$ ).

$$C_p = \frac{\text{DESIGN TOLERANCE}}{\text{PROCESS TOLERANCE}}$$

## PART B

1. With suitable example, explain various stages of building a House of quality matrix. (May/June 2014)(May/June 2013) (Nov/Dec 2012)(May/June 2012)(Nov/Dec 2009)(April/May 2015)(April/May 2014) (Nov /Dec 2013) (April/May 2015) (Nov/Dec 2010) (Nov/Dec 2015) (Nov/Dec 2014)

Describe a basic structure of house of quality, a primary planning tool used in quality function deployment.(NOV/DEC 2016)

Quality function deployment is a systematic and organized approach of taking customer needs and demands into consideration while designing new products and services or while improving the existing products and services.

Definition:

Quality function deployment may be defined as a system for translating consumer requirements into appropriate requirements at every stage, from research through product design and development, to manufacture, distribution, installation and marketing, sales and service.

### OBJECTIVES OF QFD:

1. To identify the true voice of the customer and to use this knowledge to develop products which satisfy customers
2. To help in the organization and analysis of all the pertinent information associated with the project.
3. Quality function development aims at translating the customers voice into product specifications.

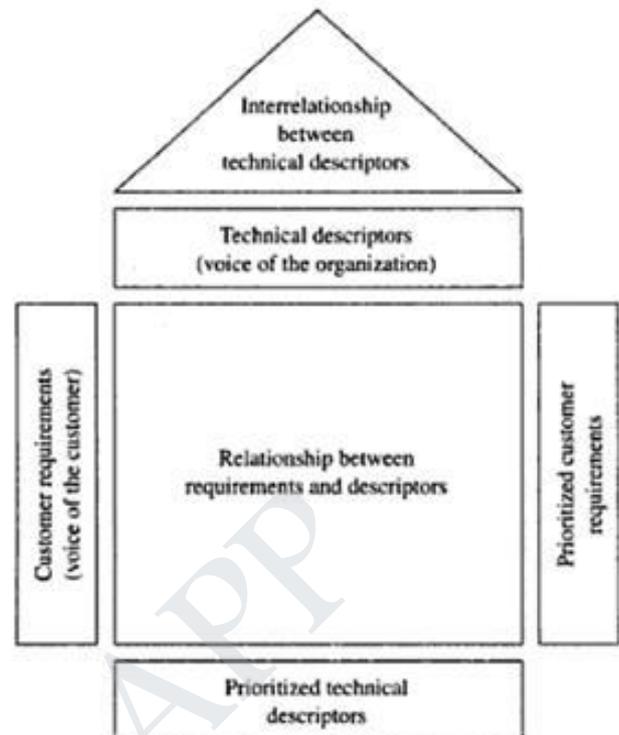
### House of Quality:

The primary planning tool used in QFD is the house of quality. The house of quality converts the voice of the customer into product design characteristics. QFD uses a series of

matrix diagrams, also called „quality tables“, resembles connected houses.

**Basic structure of house of quality:**

1. Customer requirements
2. Prioritized customer requirements
3. Technical descriptors
4. Relationship matrix
5. Prioritized technical descriptors
6. Competitive assessments
7. Develop a relationship matrix between WHATS AND HOWS



**I-Customer requirements (voice of the customer)**

The exterior walls of the house are the customer requirements.

**II-prioritized customer requirements**

The prioritized customer requirements or planning matrix are listed. Some of the listed items include customer benchmarking, customer importance rating, target value, scale-up factor and sales point.

**III-Technical descriptions (voice of the organization)**

The second floor, or ceiling, of the house contains the technical descriptors. Product design characteristics, expressed in engineering terms, are located in this ceiling.

**IV-Relationship between requirements and descriptions**

The interior walls of the house are the relationships between customer requirements with product characteristics.



- Measure the priority of these wants and dislikes using weighing scores.

**Step2: List technical descriptors**

Translate the identified customer wants into corresponding „hows“ or design characteristics .Express them in terms of quantifiable technical parameters or product specifications.

**Step3: Develop a relationship between WHATS AND HOWS**

- Investigate the relationships between the customers“ expectations(WHATs) and the technical descriptors(HOWs).
- If a relationship exists, categories it as strong, medium or weak (or by assigning scores)

**Step4: Develop a interrelationship matrix between HOWS**

- Identify any interrelationships between each technical descriptors
- These relationships are marked in the correlation matrix by either positive or negative positive means strong relationship and negative means strong relationship.

**Step5: Do competitive assessments**

- Compare the performance of the product with that of competitive products.
- Evaluate the product and note the strong and weak points of the product against its competitors product according to the customer.

**Step6: Develop prioritized customer requirements**

- Develop the prioritized customer requirements corresponding to each customer requirements in the house of quality on the right side of the customer competitive assessment.

**Step7: Develop prioritized technical descriptors.**

- Develop the prioritized technical descriptors corresponding to each technical descriptor in the house of quality below the technical competitive assessment

**Benefits:**

- Promotes better understanding of customer demands.
- Improves customer satisfaction
- Promotes team work.
- Facilitates better understanding of design interactions
- Concentrate on design work.

**2.Explain the pillars of TPM and its benefits (May/June2014)(Nov/Dec 2012)  
(Nov/Dec 2011)(April/May 2015) (Nov/Dec 2010) (Nov/Dec 2015) (May/June 2017)**

- Maintenance is defined as the management, control, execution and quality assurance of activities which ensures the achievement of optimum availability and performance of a plant in order to meet business objectives.
- Total Productive maintenance (TPM) is a systematic execution of maintenance by all employees through small group activities.
- Total – All encompassing maintenance and production individuals working together.
- Productive – Production of goods and services that meet or exceed customers’ expectations
- Maintenance – Keeping equipment and plant in as good as or better than the original condition at all times.

**Objectives:**

The five goals of TPM are:

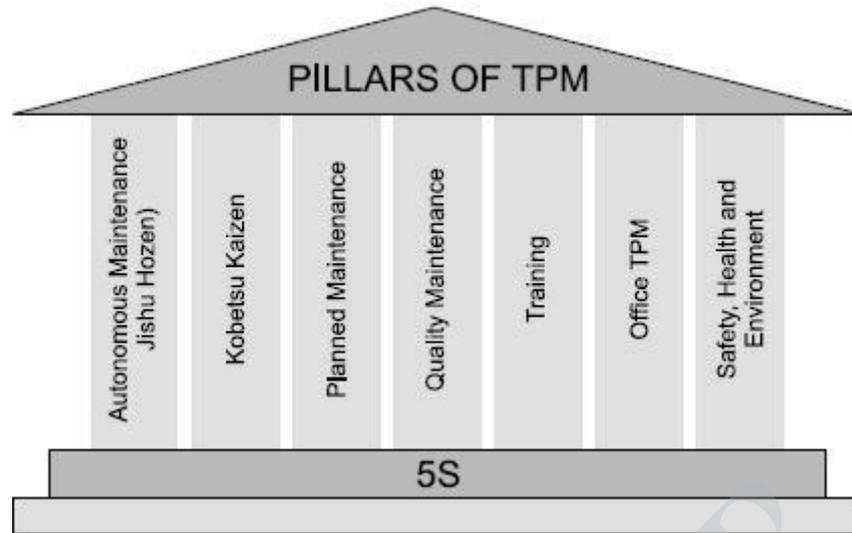
1. To improve equipment effectiveness- TPM examines the effectiveness of facilities by identifying and examining all losses, like down-time losses, speed losses and defect losses.
2. To achieve autonomous maintenance- TPM allows the people who operate equipment to take responsibility of the maintenance tasks.
3. To plan maintenance: TPM has a systematic approach to all maintenance activities. This involves the identification of the nature and level of preventive maintenance required for each piece of equipment.
4. To train all staff in relevant maintenance skills: TPM places a heavy emphasis on appropriate and continuous training to all operating and maintenance staffs.
5. To achieve early equipment management: TPM aims to move towards zero maintenance through Maintenance Prevention (MP).

**Concept of TPM:**

Main concept of TPM is that everyone from the operator to top management is responsible for maintenance activities.

TPM embraces various disciplines to create a manufacturing environment where in everyone feels that it is her/his responsibility to keep the equipment running and productive.

## Eight Pillars of TPM



### 1. Autonomous Maintenance (Jishu Hozen)

- Jishu Hozen, which is a Japanese word means autonomous maintenance or self-autonomous
- To autonomous maintenance promotes development of production operators to be able to take care of small maintenance tasks, such as cleaning, inspection, and lubricating their equipment

### 2. Kobetsu kaizen (individual improvement):

- Kobetsu kaizen (KK) or individual improvement is to move towards zero losses of all kinds.
- All kinds of losses are identified, their current level calculated and goals are set for improvement in overall equipment efficiency (OEE).

### 3. Planned maintenance:

Planned maintenance (PM) has an objective of improving the efficiency of the maintenance department.

PM comprises the following types of maintenance:

- Preventive maintenance
- Daily maintenance
- Periodic maintenance

### 4. Hinshitsu Hozen (Quality Maintenance)

- Hinshitsu Hozen (HH) which in Japanese, means quality maintenance, is aimed towards customer delight through highest quality through defect free manufacturing.
- Quality maintenance activities are to set equipment conditions that preclude quality

defects, based on the basic concept of maintaining perfect equipment to maintain perfect quality of products.

#### **5. Development Management:**

- It is also known as early management of new equipment.
- The objective of development management is to establish systems to shorten:
  - o New product or equipment development.
  - o Start-up, commissioning and stabilization time for quality and efficiency.
- New equipment needs to be easy to operate; easy to clean; easy to maintain and reliable; have quick set-up and operate at the lowest life cycle cost.

#### **6. Education and training:**

- The goal of education and training is to have multi-skilled revitalized employees whose morale is high and who are eager to come to work and perform all required functions effectively and independently.
- This pillar captures the knowledge gaps as they are identified, develops appropriate solutions for training and education and ensures they are delivered through a programme of structured development for the entire workforce.

#### **7. Safety, health and environment**

The target of the safety, Health and environment pillar is

- Zero accidents
- Zero health damage and
- Zero fires.

#### **8. Office TPM**

As the name suggests, office TPM focuses upon improving the productivity and infusing efficiency in the administrative support functions of the organization by identifying and eliminating losses.

#### **Similarities between TQM and TPM:**

- Total commitment to the program by top management is required in both programmes
- Employees must be empowered to initiate corrective action.
- A long-term outlook must be accepted, as TPM may take a year or more to implement and is an on-going process.

**3.What are the 6 big losses of company? Discuss the steps to implement TPM**

**Objectives:**

The five goals of TPM are:

- To improve equipment effectiveness- TPM examines the effectiveness of facilities by identifying and examining all losses, like down-time losses, speed losses and defect losses.
- To achieve autonomous maintenance- TPM allows the people who operate equipment to take responsibility of the maintenance tasks.
- To plan maintenance: TPM has a systematic approach to all maintenance activities. This involves the identification of the nature and level of preventive maintenance required for each piece of equipment.
- To train all staff in relevant maintenance skills: TPM places a heavy emphasis on appropriate and continuous training to all operating and maintenance staffs.
- To achieve early equipment management: TPM aims to move towards zero maintenance through Maintenance Prevention (MP).

**What are the 6 Big losses?**

1. Breakdowns- Long interruptions, expensive repairs
2. Setup and changeover- Taking much longer than needed.
3. Idling and minor stoppages-Hard to quantify, add up to big losses.
4. Reduced speed- Equipment cycle times have gradually.
5. Defects and rework – Quality losses and unhappy customers.
6. Start up losses – Too long to get to steady state after a change

**Twelve steps for TPM development:**

Stage	Step	Details
<b>1. Preparation stage</b>	1. Announce top management about the decision to introduce TPM	Use statement at TPM lecture in company, articles in company, newspaper
	2. Launch education and campaign to introduce TPM	Use seminars, slide presentations, retreats, etc.
	3. Create organization to promote teams.	Create special committees at top, medium and lo-levels and assign staffs

	4. Establish basic TPM policies and goals	Analyze existing conditions, set goals and predict results
	5. Formulate basic TPM policies and goals	Prepare detailed implementation plans.
<b>2. Preliminary Implementation stage</b>	6. Hold TPM kickoff	Invite clients, affiliated and subcontracting companies.
<b>3. TPM implementation stage</b>	7. Improve effectiveness of each piece of equipment	Select model equipment and form project teams.
	8. Develop an autonomous maintenance program	Build diagnosis skills and establish worker certification procedure.
	9. Develop a scheduled maintenance program for maintenance department	Include periodic and preventive maintenance and management of spare parts, tools, blue prints and schedule.
	10. Conduct training to improve operation and maintenance skills	Train leaders together. Leaders share information with group members
	11. Develop early equipment management program,	Design, commission and control the maintenance prevention program
<b>4. Stabilisation</b>	12. Perfect TPM implementation and raise TPM level	Evaluate TPM and set higher goals

**Overall Equipment Effectiveness (Measures of TPM)**

**Breakdowns and Setup and changeover:**

$$\text{Availability} = \frac{\text{loading time} - \text{Down time}}{\text{Loading time}} * 100$$

Eg) Availability = (460min - 60min / 460 min) \* 100 = 87 %

**Defects and rework and Start up losses:**

Eg) Rate of quantity products = (400 - 8 / 400) \* 100 = 98 %

**Overall Equipment Effectiveness** = Availability \* Performance efficiency \* Rate of quality products

OEE = 0.85 \* .50 \* 98 \* 100 = 42.5%

**Benefits of TPM (TPM Achievement)**

- To achieve autonomous maintenance
- To improve equipment effectiveness
- To plan maintenance
- To train all staff in relevant maintenance skills
- Improved safety
- Improved return on investment
- Low maintenance and production cost
- Enhanced job satisfaction.

**4. Explain the Taguchi's quadratic quality loss function. How it differs from traditional approach of quality loss cost? (May/June 2013)(Nov/Dec 2011) (Nov/Dec 2009)(Nov/Dec 2014) (Nov/Dec 2014)**

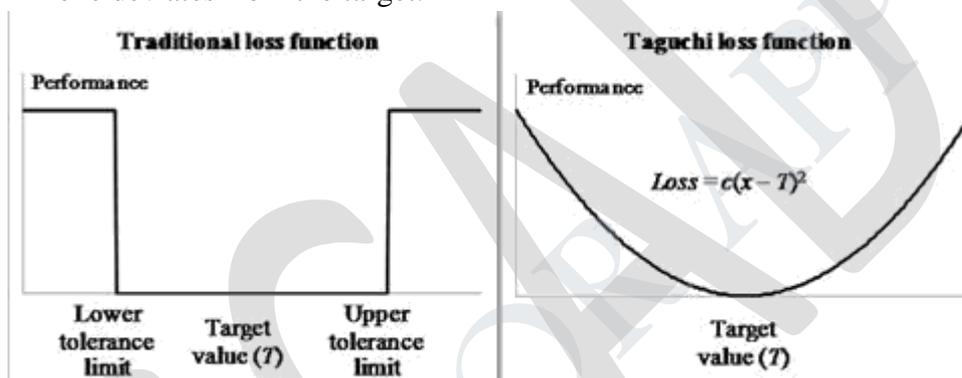
- Taguchi's methods are statistical methods developed largely by Genichi Taguchi to improve the quality of manufactured goods
- Taguchi methods are controversial among many convention western statisticians.

Taguchi's principle contributions to statistics are:

1. Taguchi loss function;
2. the philosophy of off-line quality control; and
3. Innovations in the design of experiments.

**Taguchi loss function:**

- Taguchi defines quality as “the loss imparted by the product to society from the time the product is shipped”.
- This loss includes costs to operate, failure to function, maintenance and repair costs, customer dissatisfaction injuries caused by poor design and similar costs.
- Defective products/ parts that are detected repaired reworked or scrapped before shipment are not considered part of this loss.
- The essence of the loss function concept is that whenever a product deviates from its target performance it generates a loss to society.
- This loss is minimum when performance is right on target, but it grows gradually as one deviates from the target.



Therefore the loss function philosophy says that for a manufacturer, the best strategy is to produce products as close to the target as possible, rather than aiming at “being”

**Taguchi’s Approach Vs Traditional Approach**

Consider two products and one is within the specified limits and the other is just outside of the specified limits. In the traditional approach, the product within the limits is considered as a good product while the outside one is considered as bad product.

Taguchi’s disagrees with its traditional approach. He believes that when a product moves from its target value, that move causes a loss no matter if the move falls inside or outside the specified limits.

**Loss Function:**

Quality loss occurs when a product’s specifications deviates from target or nominal value. No matter how small the deviation, there is some loss in quality. If the deviation grows , then the loss increases.

Taguchi has defined quality as the loss imparted to society from the time a product is shipped. Societal losses include failure to meet customer requirements, failure to meet idea

performance, and harmful side effects. Many practitioners have included the losses due to production such as raw material energy and labor consumed on unusable products or toxic by-products.

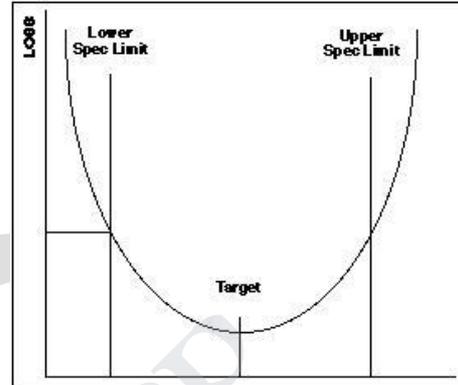
Taguchi uses a quadratic equation to the U-shaped curve. The Quality loss function (QLF) is given by the relation

$$L(x) = k(x-N)^2$$

Where  $L(x)$  = Loss Function

$K$  = Constant of proportionality

$X$  = Quality characteristics of selected product  
 $N$  = Nominal value of the chosen product  
 $(x-N)$  = Tolerance



To estimate the loss, the value of „k“ in previous equation should be determined first

$$K = C/d^2$$

$C$  = Loss associated with the specification limit

$d$  = Deviation of the specification from the target value.

**5. Explain measures of performance in evaluating the success of an organization. Also discuss the techniques for presenting performance measures. Nov/Dec 2012)( (Nov/Dec 2014)**

Performance measures indicates the measurement of success in an organization

**Objectives:**

- To establish baseline measures and reveal trends
- To indicate process gains and losses
- To compare goals with actual performance
- To provide information for individual and team evaluation
- To provide information to make informed decisions
- To determine the overall performance of the organization.

**Performance indicators:**

- The performance measures of its each functional elements such as customers , production, suppliers , research and development, human resources, marketing/sales and administration.

1. Customers	<input type="checkbox"/> Number of warranty claims <input type="checkbox"/> Number of suggestions per employee <input type="checkbox"/> Number of suggestion implemented <input type="checkbox"/> % returns by customers <input type="checkbox"/> Time to resolve complaints <input type="checkbox"/> Number of customer“ complaints	STUCOR APP
2. Production	<input type="checkbox"/> Productivity=output/input=results/costs <input type="checkbox"/> Labour productivity=results/labour costs <input type="checkbox"/> Capital productivity=results/capital costs <input type="checkbox"/> Material productivity= result/material costs <input type="checkbox"/> Effectiveness=actual result/expected result <input type="checkbox"/> Efficiency=expected costs/actual costs.	
3. Suppliers	<input type="checkbox"/> Service rating <input type="checkbox"/> On-time delivery <input type="checkbox"/> Quality performance <input type="checkbox"/> SPC charts <input type="checkbox"/> Billing accuracy <input type="checkbox"/> Average lead time <input type="checkbox"/> Justin-time delivery target.	
4. Research and Development	<input type="checkbox"/> New product time to market <input type="checkbox"/> Time needed to launch a new product <input type="checkbox"/> Design change orders <input type="checkbox"/> Cost estimating errors <input type="checkbox"/> % of sales from new products	
5. Human Resources	<input type="checkbox"/> % personnel turnover <input type="checkbox"/> % absence due to illness <input type="checkbox"/> Employee satisfaction index <input type="checkbox"/> Number of training hours per employee <input type="checkbox"/> Number of active teams <input type="checkbox"/> % safety incidents	
6. Marketing/	<input type="checkbox"/> Sales growth	

	Criteria Indicators/Determinants
Sales	<input type="checkbox"/> Market growth <input type="checkbox"/> % delivery completed <input type="checkbox"/> Sales expense to revenue <input type="checkbox"/> New customers <input type="checkbox"/> Sales income to number of sales people <input type="checkbox"/> Order accuracy
7. Administration	<input type="checkbox"/> Revenue growth <input type="checkbox"/> Revenue per employee <input type="checkbox"/> Expense to revenue <input type="checkbox"/> Cost of poor quality <input type="checkbox"/> %of payroll distribution on time <input type="checkbox"/> Office equipment up-time <input type="checkbox"/> Order entry/billing accuracy <input type="checkbox"/> Invoicing speed.

**PERFORMANCE MEASURES PRESENTATION:**

Six basic techniques for presenting performance measures are:

- Time series trend graphs
- Control charts
- Capability index
- Taguchi's loss function
- Costs of poor quality
- Quality awards

**a. Time series trend graphs:**

- A trend graph provides information for the investigation and assessment of quality improvement programmes
- In the time series graph, the time is represented on the X-axis and the performance measures is represented on the Y-axis.

**b. Control charts**

A **control chart**, invented by Walter A. Shewhart, is the most widely used tool in statistical process control (SPC).

- A control chart is a graph that displays data taken over time and the variations of this data.
- A histogram gives a static picture of process variability, whereas a control chart illustrates the dynamic performance (i.e., performance over time) of the process.
- The control chart is based on a series of random samples taken at regular intervals.

**c.Process Capability index**

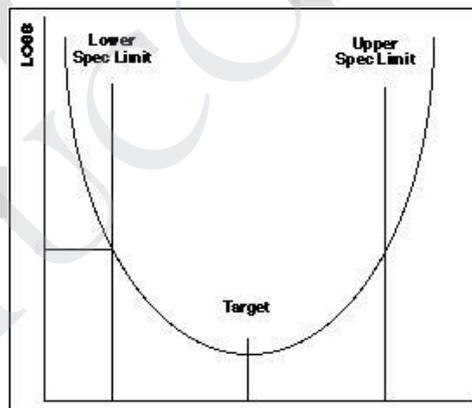
Process capability index is the ratio of the tolerance to the capability

$C_p$  : It measures the ability of the process to meet specifications

$C_{pk}$  : It indicates the centering of the process on the target.

**d.Taguchi’s loss function**

The essence of taguchi’s quality loss function (QLF) concept is that whenever a product deviates from its target performance, it generates a loss to society. This loss is minimal when performance is right on target, but it grows gradually as one deviates from the target.



**e.Costs of poor quality:**

Quality cost is the cost of not meeting the customers’ requirement ie., the cost of poor products and services

The cost of quality can be classified into following four categories

- Cost of prevention
- Costa of appraisal
- Costa of internal failures
- Costs of external failures

**f. Quality awards**

- The criteria of any quality awards should include leadership, strategic planning, customer and market focus, information and analysis, human resources focus, process management and business results.

**6. Explain in detail process capability (Nov /Dec 2008) (NOV/DEC2016)**

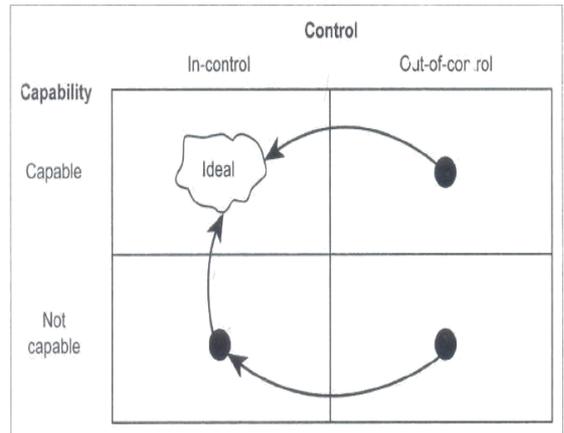
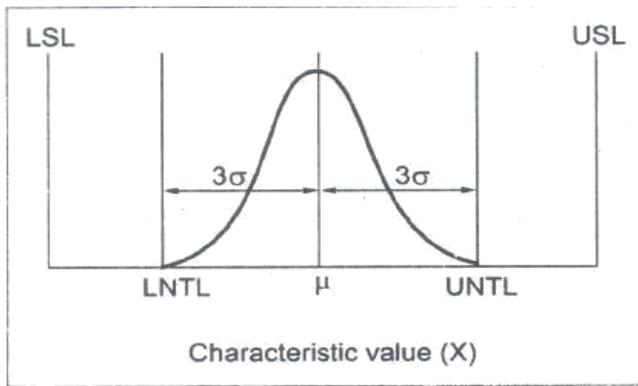
- Control limits are derived from actual process performance, and are designed to show whether the process is in statistical control or not.
- Specification limits are usually derived from customer requirements. These limits are placed on a product characteristic by designers and engineers to ensure adequate functioning of the project.
- Generally two types of specification limits: (i)LSL(Lower Specification Limit)  
(ii)USL(Upper specification limits)

These limits quantify the requirements of customer. If a product falls in the range of USL/LSL.thr product is said to be meeting our customer’s expectation and vice versa.

S.No.	Control limits	Specification limits
1	Voice of the process	Voice of the customer
2	Calculated from data	Defined by customer
3	Appear on control charts	Appear on histograms
4	Apply to sample or subgroups	Apply to items
5	Guide for process actions	Separate good items from bad
6	What the process id doing	What we want the process to do

**Capability and control:**

Capability and control are two different concepts



Every process to be both capable and in control

- If a process is neither capable no in-control, we must first get it in a state of control by removing special causes of variation, and then attack the common causes to improves its capability.
  - If a process is capable but not in control, we should ask to get it back in-control.
- Natural Tolerance Limits:

Natural tolerance limits, also known as process capability limits, are used in process capability study.

If  $\mu$  = process mean

$\sigma$  = process standard deviation

Then,

$$\text{upper Natural tolerance limit(UNTL)} = \mu + 3 \sigma$$

(upper Natural capability limit(UPCL))

$$\text{Lower Natural tolerance limit(LNTL)} = \mu - 3 \sigma$$

(Lower Natural capability limit(LPCL))

**Specifications and process capability:**

**(Relationship between tolerance limit and specification limits)**

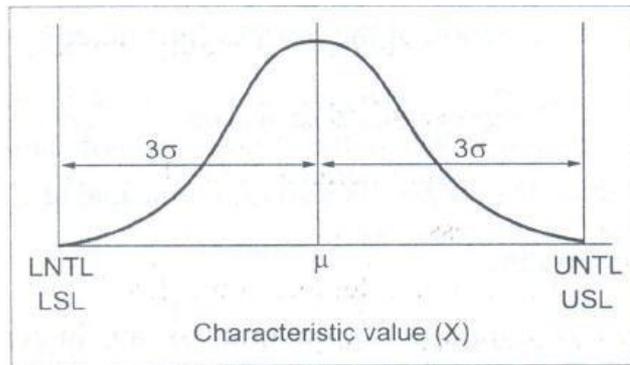
Three cases:

**Case 1: When process Spread less than specification spread**

If the process spread (UNTL-LNTL) is less than the difference between the specification limits(USL-LSL), then the process is quite capable.

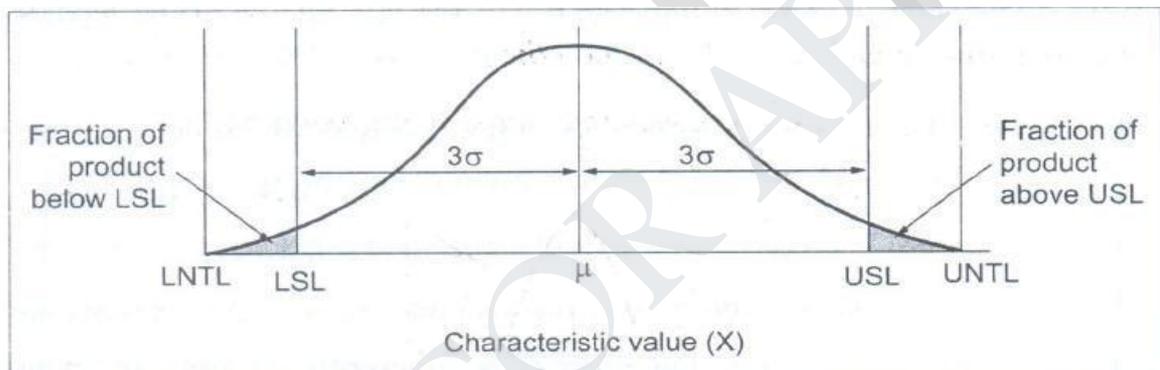
**Case 2: When process spread equal to specification Spread**

If the process spread is the same as the difference between the specification limits, then the process is still capable.



**Case 3: When process spread Greater than specification spread**

If the process spread is greater than the difference between the specification limits, then the process will be producing non conforming products.



**Process capability Analysis:**

Probability capability analysis estimates process capability. It involves estimating the process mean, process standard deviation and the relative frequency distribution of the quality characteristic. If specification limits are known, a process capability analysis will also estimate the propagation of non conformity product.

Probability capability analysis with variable data can be performed only when the following two critical conditions/assumptions are met:

1. The process is in statistical control
2. The distribution of the process considered is “Normal”.

**Process capability:**

Process capability is defined as the minimum spread of a specific measurement variation which will include 99.7 % of the measurements from the given process.

$$\text{Process capability} = 6\sigma$$

**Process capability indices (Measures of process capability)**

**(i) Process capability index  $C_p$**

This is the process capability index that indicates the process potential performance by relating the natural process spread to the specification spread. It is often used during the product design phase and pilot production phase.

$$C_p = \frac{\text{Total specification}}{\text{process capability}}$$

$$C_p = \frac{USL - LSL}{6\sigma}$$

USL = Upper specification Limit

LSL = Lower Specification Limit

USL- LSL = Tolerance

$\sigma$  = population standard deviation

$6\sigma$  = Process capability

$C_p$  = Capability index

**Interpretation of  $C_p$ :**

If  $C_p > 1$  means that the process variation is less than the specification

If  $C_p < 1$  means that the process is not capable of meeting the specifications.

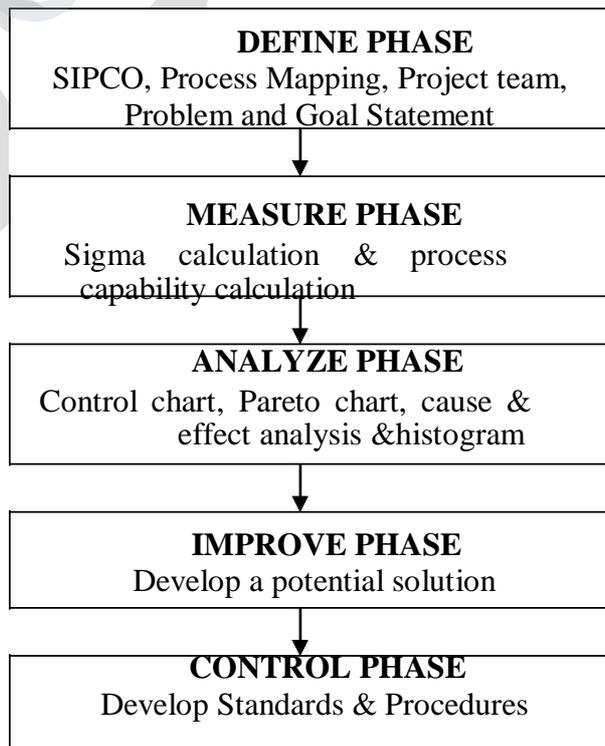
If  $C_p = 1$  means that the process is just meeting specifications.

**(ii) Process capability index  $C_{pk}$**

$C_{pk}$  Measures not only the process variation with respect to allowable specifications, it also considers the location of the process storage.

$$\text{Process capability index } C_{pk} = \min\{ \frac{USL - \text{Mean}}{3\sigma} \text{ or } \frac{\text{Mean} - LSL}{3\sigma} \}$$

**7.a. Illustrate the key characteristics of six sigma (NOV/DEC 2016)**



## **DEFINE PHASE**

It defines the scope and goals of the improvement project in terms of customer requirements and the process that delivers these requirements.

## **SIPOC**

SIPOC (Supplier, Input, Process, Output, and Customer) is a high level tool that identifies who are your supplier, what he supplies, how it is converted to the required form, what we get as a outcome and who is going to get it.

## **Process Mapping**

A graphical display of the steps, events, and operation in sequence that makes up the process. It is a high-level process tool, which tells the detail of all the activity, involved in manufacturing of the product.

## **15-word flip chart**

It is a team tool, which allows team members to draft a simple 15-word statement of the project scope. It clearly explains the problem statement and the goal statement of the project that had to undertaken.

The team is formed to solve the critical to quality problem and they are given training regarding the quality tools and others. According to the level of training they are given “belt” which represents their role in the project.

## **Executive leaders**

He or she should set the tone and direction for six-sigma effort and they have to commit themselves and promote it throughout the organization.

## **Champions**

He or She serves as a coach in supporting the project teams for implementing the six sigma and providing them the required resource for their work.

## **Master Black belts**

He or She is the highest levels of technical proficiency and must be an expertise in six sigma tools.

## **Black belts**

He or She is the backbone of six-sigma culture and takes responsibilities for the routine work and results of six-sigma project. They are key agents, fully dedicated and thoroughly trained in six sigma techniques and tools.

*Green Belt*

He or She are responsible for collection and analysis of data needed to improve the process and usually receive more simplified training than black belts and work on projects only on part time.

*Team Members*

He or She must have sufficient functional expertise relevant to the project undertaken. They must be able to work well with others and have technical skills to contribute significantly to the team.

**MEASURE PHASE**

It measures the current performance input, output, and process and calculates the sigma level. In this Phase we do

**I] Sigma calculation**

**II] Process capability calculation**

**Sigma calculation**

Parts per Million (PPM): The number of defective item out of one million inspected item.

Defects per Unit (DPU): It is defined as ratio between the Number of unit defective to Number of unit inspected.

$$DPU = \frac{\text{Number of unit defective}}{\text{Number of unit inspected}}$$

Defects per Opportunities (DPO): It is defined as ratio between Defects per unit to Number of independent opportunities for non-conformance per unit.

Where m- Number of independent opportunities for non conformance /unit

Defects per Million Opportunities (DPMO): It is the number of defective opportunities, which do not meet the required specification out of one million opportunities.

$$DPMO = DPO \times 10^6$$

Yield: It tells the performance of the process in terms of percentage.

$$YIELD = 1 - DPU$$

**PROCESS CAPABILITY**

In any manufacturing process, the variability is inherent and cannot be eliminated fully though it can be controlled to some extent. The extent of variability decides Go, Non-Go or Acceptance, Rejection of the products. Statistics renders an immense help to assess this variability quantitatively and to take the correction action promptly before any disaster that may occur as a consequence. Process capability study is a statistical tool or technique, to

assess the variation in the ability of the process during the conversion of feed material.

### Process capability

It is defined as the quality performance capability of the process with given process factors and under normal, in control condition. Based on the results of any process that are continuously measured, standard deviation is calculated by taking the square root of its variance to calculate the indices of process capability namely CP and Cpk. The need for process capability is to

- iv. Predict the extent to which the process will be able to hold tolerance or customer requirements.
- v. Choose, from among competing process, the most one for meeting the customer requirements.
- vi. Redesign and implement a new process that eliminates the source of variability now at work.

The two type of Process capability are:

**a) Potential capability index (Cp):** The potential process capability measures the overall performance of the process and is measured as the ratio of difference between upper specification limit (USL) and lower specification limit (LSL) to six times of standard deviation ( $\sigma$ ).

**b) Performance capability Index (Cpk):** The index CP calculates the precision of the process by measuring the overall processes performance, consideration the both positive and negative deviation. This is alone not sufficient, since there is every chance for lack of accuracy in the process. To assess the accuracy, clustering nature of values around the mean or away from the center value are calculated. Using performance capability index (Cpk) the clustering effect on Lower limit is calculated by CPKL & Upper limit is calculated by CPKU and minimum of the above is Cpk.

### ANALYZE PHASE

It analyzes the gap between the current performance levels with the desired performance level. In this problems are identified and prioritized for solving it by identifying root cause of the problem.

### Pareto Chart

It is a process tool to classify data and rank categories in descending order of occurrence to separate significant categories from trivial ones. Separating data into category, counting occurrences in each category, and arranging categories from highest to lowest frequency and

drawing and labeling bars for each category does it.

### **Cause and Effect Diagram**

It is called as Fishbone diagram which a process tool to identify possible causes for a particular effect.

### **IMPROVE PHASE**

It involves in generating the improvement solutions for the problem and chooses the best one for implementation, which will satisfy the goals.

### **CONTROL PHASE**

It involves in putting measures in place to make sure that the new process is monitored and continuously improved.

### **7.b.Explain the differences between x-bar and R-charts. How can they be used together and why would it be important to use them together? (NOV/DEC 2016)**

The x-bar chart is used to detect variations in the mean of the process, while the R-chart is used to detect changes in the variability of the process. The x-bar and R-charts are used when the data is a variable, meaning that we can collect data using decimal points, such as 16.5 ounces. Examples of variables are weight, height and temperature.

The x-bar and R-charts should be used together. Think about preparing a Thanksgiving turkey in the oven. What can go wrong with the temperature of the oven if it is set at 350 degrees? The average temperature during cooking could be 250 degrees instead. On the other hand, the temperature could average 350 degrees, but actually fluctuate during cooking time between 200 and 500 degrees. Either way, the turkey will not be properly cooked in the oven. The inaccurate average temperature would have been detected by the x-bar chart. The changes in the temperature would have been detected by the R-chart. We use these charts together by plotting the average of the sample on the x-bar chart and the range (high temperature in the sample minus the low temperature) on the R-chart. Then, we first interpret the R-chart. If it is out of control, then the process variation is out of control. The next step would be to investigate the cause of this problem. There is no need to interpret the x-bar chart if the R-chart is out of control. If the variation is out of control, it is not possible to make conclusions about the average because the variation would probably change the average. If the R-chart is in control, then we interpret the x-bar chart. If it is out of control, then the process average is out of control.

**UNIT V**  
**QUALITY SYSTEMS**  
**PART A**

**1. Why is a quality system required? (May/June 2014)**

- It provides an opportunity to increase value to the activities of the organization.
- It improves the performance of processes /activities continually
- It improves customer satisfaction
- It implements statutory and regulatory requirements to product /services

**2. What are the objectives of ISO 9000 standards (May/June 2014)(Nov/Dec 2013)**

The objectives of ISO 9000 standards are:

- To achieve, maintain and seek to continuously improve product/service quality.
- To improve the quality of operations to continually meet customers' and stakeholder's stated and implied needs.
- To provide confidence to internal management and other employees that quality requirements are being fulfilled and that improvement is taking place.
- To provide confidence to customers and other stakeholders that quality requirements are being achieved in the delivered product.

**3.What is internal quality audit and external quality audit? (Nov/Dec 2013) (May/June 2017)**

- In internal audit, audit is done by an organization, working on itself.
- In external audit, audit is done by an independent organization for accreditation purposes.

**4.Compare QS 9000 with TS16949 quality system. (April/May 2015)**

- Though both are related to automotive quality system standards, now QS9000 is being replaced by ISO/TS 16949 standards.
- QQS 9000 is basically a product approach where as TS 16949 is a process approach
- The other important difference between QS9000 and ISO/TS 16949 relate to the aspects of customer satisfaction and employee motivation.
- In ISO/TS 16949, there is much focus on documentation and more focus on how the system is performing in achieving customer satisfaction.

**5.Explain briefly the Environment management system (Nov/Dec 2014)/ (May/June 2013)**

The overall objective of ISO 14000 Environmental management Standard is to encourage environmental protection and pollution prevention while taking into account the economic needs of society.

An EMS meeting the requirements of ISO 14001:2004 is a management tool enabling an organization of any size or type to:

- identify and control the environmental impact of its activities, products or services, and to
- improve its environmental performance continually, and to
- Implement a systematic approach to setting environmental objectives and targets, to achieving these and to demonstrating that they have been achieved.

**6. Differentiate between ISO 9000 and QS 9000 (Nov / Dec 2014) (Nov/Dec 2012)**

- The QS 9000 is a set of quality system requirements to help automotive suppliers to ensure that they are meeting/ exceeding customer requirements.
- The QS 9000 standards are very specific to automotive industry, whereas ISO 9000 series of standard can be applied to any organization both(manufacturing and service industries)

**7. What is organization standards and product standards?(May/June 2013)**

**Organization standards** outline the way in which business is to be conducted and govern what is deemed as acceptable behavior in the workplace.

**Product standards** is a standard that lays down the requirements to be accomplished by a product or a group of products, to certify its fitness for use.

**8. List out the global benefits of adopting ISO 9000 quality system.(Nov/Dec 2012)**

- ISO 9000 quality system provides an opportunity to increase value to the activities of the organization.
- It improves the performance of processes/activities continually
- It ensures the satisfaction of customers
- It enables better management control.

**9. List down the main elements of ISO 14000.(May/June 2012)**

General requirements

- Environmental policy

- Planning
- Implementation and operation
- Checking and corrective action

**10. What are the general requirements of quality management system?(Nov/Dec 2011)**

The organization shall establish, document, implement and maintain a quality management system and continually improve its effectiveness in accordance with the requirements of this International Standard.

The organization shall

- a) determine the processes needed for the quality management system and their application throughout the organization
- b) determine the sequence and interaction of these processes,
- c) determine criteria and methods needed to ensure that both the operation and control of these processes are effective,
- d) ensure the availability of resources and information necessary to support the operation and monitoring of these processes,
- e) monitor, measure (where applicable), and analyse these processes, and
- f) implement actions necessary to achieve planned results and continual improvement of these processes.

**11. List out the various product evaluation standards of ISO 14000.(Nov/Dec 2010)**

- Environmental Aspects in Product Standards (EAPS)
- Environmental Labels and Declarations (ELD) and
- Life Cycle Assessment (LCA)

**12. Name any two generic ISO standards. Why it is called generic standards?(NOV/DEC2016)**

ISO 9001:2008 specifies requirements for a quality management system where an organization

- Needs to demonstrate its ability to consistently provide product that meets customer and applicable statutory and regulatory requirements, and
- Aims to enhance customer satisfaction through the effective application of the system, including processes for continual improvement of the system and the

assurance of conformity to customer and applicable statutory and regulatory requirements.

### 13. What are the core elements of QMS?

#### Elements

- Quality policy.
- Quality objectives.
- Quality manual.
- Organizational structure and responsibilities.
- Data Management.
- Processes - including purchasing.
- Product quality leading to Customer satisfaction.
- Continuous improvement including corrective and preventive action.

## PART B

### 1. Discuss the various elements of ISO 9000-2000 quality system (Nov/Dec 2014) (Nov/Dec 2013) (May/June 2013) (Nov/Dec 2012) (April/May 2015) (NOV/DEC 2016)

Definition: International Organization for Standardisation (ISO) defined the term the quality systems as follows:

“The quality system is the organizational structure, responsibilities, procedures, processes and resources for implementing quality management”

#### Elements/Clauses of ISO 9000-2000 Standard:

General clauses:

1. Scope
2. Normative reference
3. Terms and definitions
4. Technical definitions

clauses:

4. Quality Management System
5. Management responsibility
6. Resource management
7. Product realization

8. Measuring, analysis and improvement

1. **Scope:** Tells what organizations, locations, processes, products and so on are covered.
2. **Normative reference:** Normative references are other standards which, by being listed, constitute provisions of the ISO 9001 standard.
3. **Terms and definitions:** For the purpose of this international standard, the term and definitions given in ISO 9000 apply.

Supplier->Organization ->Customer

#### 4. Quality Management System

4.1 General requirements: The organization shall establish, document, implement and maintain a QMS and continually improve its effectiveness in accordance with the requirements of this international standard.

The organization shall identify the processes needed for the QMS and their application throughout the organization. It also identifies the sequence and interaction of these processes.

4.2 Documentation requirements 4.2.1 General:

The QMS documentation shall include:

- Documented statements of a quality policy and quality objectives
- A quality manual
- Documented procedures required by this international standard
- The term “Documented procedures “appears within this international standard, this means that the procedure is established, documented, implemented and maintained.

4.2.2 Quality Manual: The organization shall establish and maintain quality manual that include:

- The scope of the QMS ,including details of and justification for any exclusions
- Documented procedures and
- Descriptions of the interaction between the processes of the QMS.

4.2.3 Control of Documents: Documents required by the QMS shall be controlled. Records are a special type of document and shall be controlled.

4.2.4 Control of record: Records shall be established and maintained to provide evidence of conformity to requirements and of the effective operation of the QMS.

- Records shall remain legible, readily identifiable and retrievable

- A documented procedure shall be established to define the controls needed for the identification, storage, protection, retrieval, retention time and disposition of records.

## 5. Management responsibility

5.1 Management commitment: Top management shall provide evidence of its commitment to the development and implementation of the QMS and continually improving its effectiveness by,

- Communicating to the organization the importance of meeting customer as well as statutory and regulatory requirements
- Establishing the quality policy

5.2 Customer Focus: Top management shall ensure that customer requirements are determined and are met with the aim of enhancing customer satisfaction.

5.3 Quality policy: Top management shall ensure that the quality policy:

- Is appropriate to the purpose of the organization
- Includes a commitment to comply with requirements and continuously improve the effectiveness of the QMS.

## 5.4 Planning

5.4.1 Quality Objectives: Top management shall ensure that quality objectives, including those needed to meet requirements for product are established at relevant functions and levels within the organization.

5.4.2 Quality Management System Planning: Top management shall ensure that

- The planning of the QMS is carried out in order to meet the requirements as well as the quality objectives
- The integrity of the QMS is maintained when changes to the QMS are planned and implemented

## 5.5 Responsibility, Authority and communication

5.5.1 Responsibility and authority: Top management shall ensure that responsibilities and authorities are defined and communicated within the organization.

5.5.2 Management Representative: Top management shall appoint number of management who, irrespective of other responsibilities, shall have responsibility and authority that includes:

- Ensuring that processes needed for the QMS are established, implemented and maintained.

- Ensuring the promotion of awareness of customer requirements throughout the organization.

5.5.3 Internal Communication: Top management shall ensure that appropriate communication processes are established within the organization and that communication takes place regarding the effectiveness of the QMS.

#### 5.6 Management Review

5.6.1 General: Top management shall review the organization's QMS at planned intervals.

The review shall include assessing opportunities for improvement and the need for changes to the QMS, including the quality policy and quality objectives.

5.6.2 Review Input: The input to the management review shall include:

- Results of audits
- Customer feedback
- Process performance and product conformity

5.6.3 Review output: The output to the management review shall include

- Improvement of the effectiveness of the QMS and its processes
  - Improvement of the product related to customer requirements
  - Resource needs.

### 6. Resource management:

6.1 Provision of resources:

Organization shall determine and provide the resources needed:

- To implement and maintain the QMS and continually improve its effectiveness.
- To enhance customer satisfaction.

6.2 Human resources

6.2.1 General: Personnel performing work affecting product quality shall be competent on the basis of appropriate education, training, skills and experience.

6.2.2 Competence, Awareness and Training:

- Organization shall determine the necessary competence for personnel performing work affecting product quality.
- Organization shall Provide training or take other action taken.

6.3 Infrastructure: Organization shall determine, provide and maintain the infrastructure needed to achieve conformity to product requirements.

It include: buildings, workspace and associated utilities, process equipment etc. 6.4 Work Environment: The organization shall determine and manage the work environment needed

to achieve conformity to product requirements.

## 7. Product realization:

7.1 Planning of product realization: The organization shall plan and develop the processes needed for product realization. Planning of product realization shall be consistent with the requirements of the other processes of the QMS.

### 7.2 Customer-related processes

7.2.1 Determination of Requirements Related to the product: The organization shall determine the requirements specified by customer, including the requirements for delivery and post-delivery activities.

7.2.2 Review of Requirements Related to the product: The review of the organization shall be conducted prior to the organization's commitment to supply a product to the customer.

7.2.3 Customer communication: The organization shall determine and implement effective arrangements for communicating with customers in relation to:

- Product information
- Enquires, contracts or order handling, including amendments and
- Customer feedback, including customer complaints.

### 7.3 Design and Development

7.3.1 Design and development planning: During the design and development planning, the organization shall determine:

- The design and development stages
- The review, verification and validation that are appropriate to each design and development stage and
- The responsibilities and authorities for design and development.

7.3.2 Design and development inputs: Inputs relating to product requirements shall be determined and records and maintained. These inputs shall include:

- Functional requirements
- Applicable statutory and regulatory requirements

#### 7.3.3 Design and development outputs

Design and development outputs shall :

- Meet the input requirements for design and development
- Provide appropriate information for purchasing , production and for service provision

7.3.4 Design and development Review: Systematic review of Design and development shall be performed in accordance with planned arrangements:

- To evaluate the ability of the results of design and development to meet requirements
- To identify any problems and propose necessary actions.

7.3.5 Design and development verification: Verification shall be performed in accordance with planned arrangements to ensure that the design and development outputs have met the design and development input requirements.

7.3.6 Design and development validation: Design and development validation shall be performed in accordance with planned arrangements to ensure that the resulting product is capable of meeting requirements for the specified application or intended use.

7.3.7 Control of Design and development Changes: Design and development Changes shall be identified and records maintained. The changes shall be reviewed, verified and validated, as appropriate, and approved before implementation.

#### **7.4 Purchasing**

7.4.1 Purchasing process: The organization shall ensure that purchased product conforms to specified purchase requirements.

The organization shall evaluate and select suppliers based on their ability to supply product in accordance with organization's requirements.

7.4.2 Purchasing information: Purchasing information shall describe the product to be purchased, including where appropriate

- Requirements for approval of product, procedures, processes and equipment.
- Requirements for qualification of personnel.
- QMS Requirements.

7.4.3 Verification of purchased product: The organization shall establish and implement the inspection or other activities necessary for ensuring that purchased product meets specified purchase requirements.

#### **7.5 Production and service provision**

7.5.1 Control of production and service provision: The organization shall plan and carry out production and service provision under controlled conditions. 7.5.2 Validation of processes for production and service provision: The organization shall validate any processes for production and service provision where the resulting output cannot be verified by subsequent monitoring and measurements. 7.5.3 Identification and tractability:

The organization shall identify the product status with respect to monitoring and measurement requirements.

7.5.4 Customer property: The organization shall exercise care with customer property while it is under the organization's control or being used by the organization.

7.5.5 Preservation of product: The organization shall preserve the conformity of product during the internal processing and delivery to the intended destination. This preservation shall include identification, handling, packaging, storage and protection

4.1 Control of monitoring and measuring devices: The organization shall determine the monitoring and measurement to be undertaken and the monitoring and measuring devices needed to provide evidence of conformity of product to determined requirements.

## **8. Measuring, analysis and improvement**

8.1 General: The organization shall plan and implement the monitoring Measurement, analysis and improvement process needed:

- To demonstrate conformity of the product
- To ensure conformity of the QMS

### 8.2 Monitoring and measurement

8.2.1 Customer satisfaction: As one of the measurements of the performance of the QMS, the organization shall monitor information relating to customer perception as to whether the organization has met customer requirements.

8.2.2 Internal audit: An audit programme shall be planned, taking into consideration the status and importance of the processes and areas to be audited, as well as results of previous audits. The audit criteria, scope, frequency and methods shall be defined.

8.2.3 Monitoring and measurement of processes: The organization shall apply suitable methods for monitoring and where applicable, measurement of the QMS processes. These methods shall demonstrate the ability of the processes to achieve planned results.

8.2.4 Monitoring and measurement of product: The organization shall monitor and measure the characteristics of the product to verify that product requirements have been met. This shall be carried out at appropriate stages of the product realization process in accordance with the planned arrangement.

8.3 Control of non conforming product: The organization shall ensure that product which does not conform to product requirements is identified and controlled to prevent its unintended use or delivery. The controls and related responsibilities and authorities for

dealing with non conforming product shall be defined in a documented procedure.

8.4 Analysis of data: The organization shall determine, collect and analyze appropriate data to demonstrate the suitability and effectiveness of the QMS and to evaluate where continual improvement of the effectiveness of the QMS can be made.

8.5 Improvement

8.5.1 Continual improvement: The organization shall continually improve the effectiveness of the QMS through the use of the quality policy, quality objectives, audit results, analysis of data, corrective and preventive actions and management review.

8.5.2 Corrective action: The organization shall take action to eliminate the cause of non-conformities in order to prevent recurrence. Corrective actions shall be appropriate to the effects of the non-conformities.

8.5.3 Preventive action: The organization shall determine action to eliminate the causes of potential non-conformities in order to prevent their occurrence. Preventive actions shall be appropriate to the effects of the potential problems.

## **2. What are the needs for documentation in Quality Management System and the documents to be prepared for QMS (April/May 2015)(Nov/Dec 2014) (Nov/Dec 2010) (May/June 2012)**

### **Documentation of Quality System:**

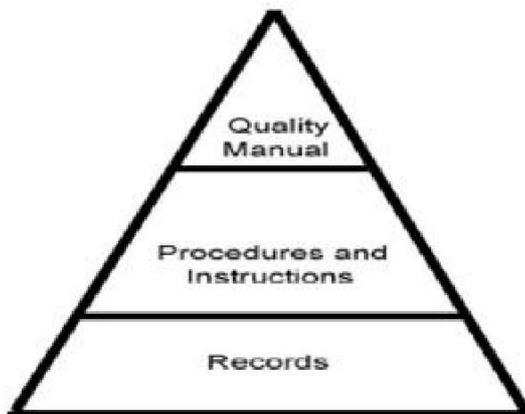
#### **I. Necessity for Documentation**

- It is understood that the proper documentation is the pre-requisite for implementing quality system.
- The document serves as a reference for the management, the staff and other agencies whose involvement is essential for implementation of the quality system.

Advantages of having a documented quality system: Documentation

- (i) serves as a reference
- (ii) brings about clarity of objectives and target
- (iii) provides standardization in work procedures
- (iv) brings about confidence consistency in operations
- (v) develops confidence amongst employees
- (vi) generates customer's confidence
- (vii) provides a basis for continuous improvement etc.

## II. Documents to be prepared



Level 1: statements of the quality policy and objectives

Level 2: Description of the activities needed to implement the system

Level 3: Detailed work documents

Level 4: Results of implementing the quality system

### 1. Quality Policy Manual (What?, Why?)

- This is the first level of documentation. This is the document that defines „what will be done“ and „why“.
- The „why“ can be stated just once as a quality policy statement. This statement should be a short and simple definition of the organization“s quality intentions
- The policy manual communicates the quality policy and objectives of an organization.
- This manual is a living document. Because it reflects the current system being followed in the organization.

### 2. Quality System Procedures (Who?, When?, Where?)

- Second level of documentation
- These procedures describe the methods that will be used to implement and perform the stated policies
- These procedures define who should perform specific tasks, when the task should be done, and where documentation will be made.
- These documents collectively define the organization“s operations from receiving an enquiry to delivering a completed product or service.

- These procedures are confidential documents of the organization and therefore need not be revealed to outsiders.

### **3. Work Instructions (how?)**

- This third level of documentation is company specific. It gives details of how individual work processes (machining, welding etc) are carried out within a company.
- Work instructions should also specify how the work should be done, who should undertake the work and what records are to be maintained.
- The work instructions may be in the form of a detailed drawing, recipe, routing sheet, specific job function, photograph, video or simply a sample for comparison of conformity.
- The work instructions should be written by the employees who perform the task.

### **4. Records, Formats, Forms (Evidence)**

- Records provide evidence of activity having been performed in compliance with quality system procedure.
- Records may be forms that are filled out, a stamp of approval on a product, or a signature and date on some type of document.
- Records are used to provide traceability of actions taken on a specific product or batch of products

### **III. Benefits of documentation:**

- Documentation regularizes the method of performing the day-to-day activities.
- It provides formats for standardizing practices
- It provides reference for assessing degree of enforcement in practice.
- It facilitates trouble shooting for tracing back on the processes
- It demonstrates the ISO quality system certification.

### **3. Explain the features of ISO 14000 and procedure to obtain ISO 14000 certification. (April/May 2015) (Nov/Dec 2010) (Nov/Dec 2013) (Nov/Dec 2014) (Nov/Dec 2011) (May/June 2014) (Nov/Dec 2016) (May/June 2017)**

An ISO 14000 standards are a set of norms for Environmental Management System (EMS) either at organization and process level or product level

The overall objective of ISO 14000 Environmental management Standard is to encourage environmental protection and pollution prevention while taking into account

the economic needs of society. An EMS meeting the requirements of ISO 14001:2004 is a management tool

enabling an organization of any size or type to:

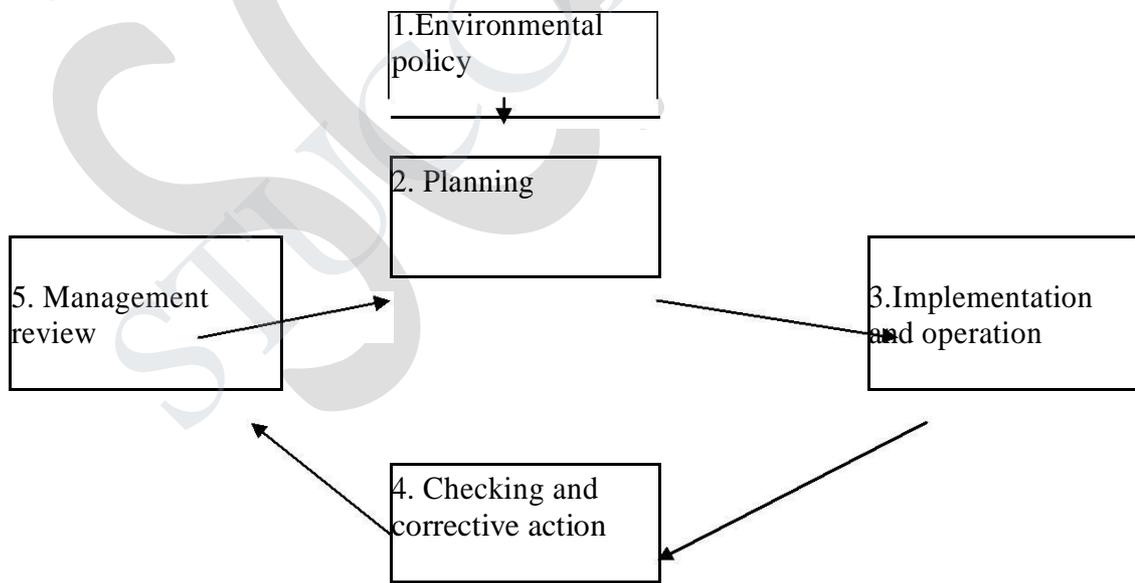
- identify and control the environmental impact of its activities, products or services, and to
- improve its environmental performance continually, and to
- implement a systematic approach to setting environmental objectives and targets, to achieving these and to demonstrating that they have been achieved.

### Concepts of ISO 14001

#### (Environmental Management System Model)

The EMS model consists of following five stages.

- Environmental policy
- Planning
- Implementation and operation
- Checking and corrective action
- Management review



Continuous improvement

#### Stage1: Environmental policy

Environmental policy should address the following issues:

- Management commitment to continual improvement

- Prevention of pollution
- Creating a framework for setting objectives
- Communication requirement with shareholders
- Education and training for environment

### **Stage 2: Planning**

This Planning stage contains four elements such as:

- (i) Environment aspects of an organization's activities, products and services should be identified in order to determine the environmental impact.
- (ii) Legal and other requirements: Organization should identify and have access to all legal and other requirements to which it subscribes.
- (iii) Objectives and targets: The organization should establish and maintain the objectives and target at each relevant function and level.
- (iv) Environmental management program(s): The organization should establish and maintain a program(s) for achieving the objectives and target.

### **Stage 3: Implementation and operation**

This stage has seven elements such as:

- Structure and responsibility
- Training, awareness and competency
- Communication
- EMS documentation
- Document control
- Operational control
- Emergency preparedness and response

### **Stage 4: Checking and corrective action**

This stage has four elements such as:

- Monitoring and measuring
- Non-conformance and corrective and preventive action
- Records
- EMS audit

### **Stage 5: Management review**

Management should review and revise the system in order to ensure the continuing suitability, adequacy, and effectiveness of the EMS.

The management must evaluate the feedback data and make improvements to the

systems.

## **Requirements of ISO 14001 (Elements/Clauses of Environmental Management System) (EMS Requirements)**

Four sections of ISO 14001 are:

Section1: Scope

Section2: Normative reference

Section3: Definitions

Section4: EMS requirements

### **4.1 General requirements**

The organization shall establish and maintain an environmental management system that includes policy, planning, implementation, operation, checking, corrective action and management review. These requirements are given in the rest of the standard.

Because the document is available to the public and other stakeholders, the organization may include a brief description of the company.

### **4.2 Environmental policy**

The organization's policy statement should be based on its mission, objectives and its value. It should reflect management commitment, leadership and direction for the environmental activities.

Top management shall define the organization's environmental policy and ensure that

- it is appropriate to the nature, scale and environmental impacts of its activities, products or services
- it includes a commitment to continual improvement and prevention of pollution
- it includes a commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organization subscribes
- it provides the framework for setting and reviewing environmental objectives and targets.
- it is documented, implemented and maintained and communicated to all employees
- it is available to the public.

### **4.3 Planning**

This area has four elements:

1. Environmental aspects
2. Legal and other requirements

3. Objectives and targets
4. Environmental management program(s).

#### 4.3.1 Environmental aspects

This relationship between the environmental aspects , environmental impacts and the standard is a prerequisite for successful implementation of the standard.

The organization shall establish and maintain (a) procedure(s) to identify the environmental aspects of its activities, products or services that it can control and over which it can be expected to have or can have significant impacts on the environment. The organization shall ensure that the aspects are considered in setting its environmental objectives. The organization shall keep this information up-to-date.

#### 4.3.2 Legal and other requirements

The organization shall establish and maintain a procedure to identify and have access to legal and other requirements to which the organization subscribes, that are applicable to the environmental aspects of its activities, products or services.

According to ISO 14004 , issues to be considered in the procedure should include, how the organization :

- a. Access and identifies legal and other requirements
- b. Keep track of legal and other requirements.
- c. Keeps track of any changes in the legal and other requirements.
- d. Communicates relevant information about legal and other requirements to employees in their organization .

#### 4.3.3 Objectives and targets

The organization shall establish and maintain documented environmental objectives and targets, at each relevant function and level within the organization. They should be consistent with the policy statement, especially with regard to the prevention of pollution.

When establishing and reviewing its objectives, an organization shall consider the legal and other requirements, its significant environmental aspects, its technological options and its financial operational and business requirements, and the views of interested parties.

#### 4.3.4 Environmental management program(s)

The organization shall establish and maintain (a) program(s) for achieving its objectives and targets.

Following requirements can be achieved with a simple form:

1. State the objective clearly
2. State the purpose of the objective
3. Describe how the objective can be achieved
4. Identify the team leader.
5. Assign departments and individual specific tasks
6. Establish a schedule for completing the task.
7. Establish program review, this includes format, content and review schedule.

#### 4.4 Implementation and operation

This area has seven elements:

- Structure and responsibility
- Training, awareness and competence
- Communication
- Environmental management system documentation
- Document control
- Operational control
- Emergency preparedness and response

##### 4.4.1 Structure and responsibility

Roles, responsibility and authorities shall be defined, documented and communicated to all personnel. They must be given necessary freedom and authority to take necessary actions.

Top management shall appoint specific environmental management representative and authority ensure that environmental management system requirements are established, implemented and maintained in accordance with this international standard.

##### 4.4.2 Training, awareness and competence

Training needs should be identified on a regular basis, to ensure effectiveness.

Two types of Training: general awareness and job competency.

General awareness includes importance of conformance to the EMS, the relationship between employees' work and its environmental impacts, employee's roles and responsibilities and the potential consequences that one will have to face if one fails to follow specific operating procedures.

Personnel who perform tasks that can cause significant environmental impacts should be competent on the basis of appropriate education, training, or experience.

##### 4.4.3 Communication

The key aspect of any management program is how effective it communicates with

all stakeholders. The standard requires that procedures should be established and maintained for internal communication among all employees.

Internal communication between the various levels and functions of the organization. Receiving, documenting and responding to relevant communication from external interested parties

Effective communication should ensure that questions are answered and that understanding is complete and accurate.

#### 4.4.4 Environmental management system documentation

The organization shall establish and maintain information describe the core elements of the management system and their interaction provide direction to related documentation.

#### 4.4.5 Document control

The organization has established and maintained procedures for controlling all documents required by the ISO 14001 standard.

The purpose of Document Control is to ensure that current versions of relevant documents are available at all locations.

ISO documentation can be viewed as four levels: Level 1: policy level

Level 2: procedural

level Level 3: Practice

level Level 4: Proof

level

4.4.6

Operational control

This element helps to align operations and activities with the identified significant environmental aspects, environmental policy, environmental objectives and targets.

#### 4.4.7 Emergency preparedness and response

Procedures are required to identify potential for and respond to accidents and emergency situations and for preventing and mitigating the environmental impacts that may be associated with them.

### 4.5 Checking and corrective action

This area has four elements:

- Monitoring and measurement
- Non-conformance and corrective and preventive action

- Records
- Environmental management system audit

#### 4.5.1 Monitoring and measurement

Effective decisions naturally require quantifiable data. The organization is required to monitor and measure the key characteristics of its objective and activities in order to assess its performance in meeting environmental operations and targets.

#### 4.5.2 Non-conformance and corrective and preventive action

Procedures are established and maintained for defining responsibility and authority for the following:

- a) Handling and investigating non-conformance
- b) Taking action to mitigate the impacts caused by nonconformance
- c) Initiating corrective and preventive action

#### 4.5.3 Records

Procedures are established and maintained for the identification, maintenance and disposal of environmental records.

Environmental records include training records, records of audit results and records of management reviews.

Environmental records are legible, identifiable and traceable to the activity, product or service involved. Environmental records are easily retrievable and are protected against damage, deterioration or loss.

#### 4.5.4 Environmental management system audit

The purpose of EMS audit is to ensure that the EMS conforms to plans and is being properly implemented and maintained. Internal and external audit information should be distributed to senior management to assist in the management review process.

### **4.6 Management review**

1. Top management periodically reviews the EMS to ensure continuing suitability, adequacy and effectiveness.
2. Necessary information is collected and provided to allow management to carry out the evaluation.
3. The review is documented.
4. Management assesses the need for changes in policy, objectives and other elements of the EMS, as indicated by environmental audit results, changing circumstances, and the commitment to continual improvement.

**Benefits of EMS.**

a. Global

- Facilitate trade and remove trade barriers
- improve environmental performance of planet earth
- Build consensus that there is a need for environment management and a common terminology for EMS.

b. Organizational

- Assuring customers of a commitment to environmental management
- Meeting customer requirements
- Maintaining a good public / community relations image
- Satisfying investor criteria and improving access to capital
- Obtaining insurance at reasonable cost
- Increasing market share that results from a competitive advantage
- Reducing incidents that result in liability

**4.(a) Discuss the benefits of ISO 9000 certification**

(May/June 2013) (May/June 2014) (May/June 2014)

**Benefits of ISO 9000.**

- It forms a solid foundation for improvement, consistency and profitability
- It provides good platform for continuous quality improvement
- It provides a status symbol for the organization and acts as powerful marketing tool
- It increases the potential market share
- It improves employees morale and ensures their total involvement
- It establishes a firm base for management of growth , change and continuing improvement
- It increases awareness of employees in company requirements and activities
- It ensures customer satisfaction
- It generates customer confidence through world-class products/services
- It ensures confidence with all stakeholders in the organization including suppliers, investors, shareholders etc.
- It improves documentation, operating standards, and housekeeping.
- It improves the perception of product quality.

- It helps in reducing the wastage and reduction in the cost of production.

**4(b) Write brief notes on Quality Auditing in QMS (4 marks (April/May 2015)(Nov/Dec 2011)(May/June 2012) (May/June 2017))**

Quality audit is the process of systematic examination of a quality system carried out by an internal or external quality auditor or an audit team. It is an important part of organization's quality management system and is a key element in the ISO quality system standard, ISO 9001.

Features of Quality Audits:

- The quality audit typically applies to quality systems or elements such as processes, products or services. Such audits are often called „quality system audits“, „process quality audits“. „Product quality audits, and „service quality service“ respectively.
- Quality audits are carried by staffs who are not directly responsible in the areas being audited. But preferably auditors should work in cooperation with relevant personnel.
- Quality audit is an information gathering activity. It is not a „police“ kind of activity.
- Quality audit may be conducted for internal or external purposes. They need not cover whole quality system, at once, but may cover elements of it

**Types of audits:**

- **First party audit (Internal audit)**, audit is done by an organization, where the auditee is its own client ie, audit is done by the organization, working on itself.
- **Second party audit:** This refers to audit by one organization on another organization (auditee). This type of audit is normally done on a supplier by a customer.
- **Third party audit(External audit):** This refers to audit by an independent organization on a supplier, for accreditation assessment purposes. The third party certification audit is carried out much in the same way as first party and second party quality system assessments and audits. However, the big difference is that an independent accredited auditing body carries out the assessment and audit, as opposed to carrying it out by the organization themselves. Also note that the organization going for third party audits are responsible for the payment of the third party audit process.

### **Objectives of Quality Audits (Need for Quality Audits)**

- To determine the conformity or non-conformity of the quality system elements with regard to specified requirements.
- To determine the effectiveness of the implemented quality system in meeting specified quality objectives
- To meet regulatory requirements, if applicable.
- To evaluate an organization's own quality system against a quality system standard,

### **Stages of an Audit:**

#### Stage 1: Audit Planning:

- Audit Schedules: It is a matrix of the timings, which details when each audit element is to be checked throughout the year
- Audit Personnel: It refers to the appointment of the auditor.
- Notification of auditee: This is the formal and timely request by audit to auditee for making available all quality system documents relevant to the audit.
- Preparation of checklist: This lists all specific questions to be asked during audit.

#### Stage 2: Execution

- Opening/entry meetings: Opening meeting is organized to initially brief the auditee about the scope of audit.
- Audit process: Audit is run to schedule and should cover entire scope, as planned. Regular liaison meetings should be held.
- Audit deficiencies: During auditing, clear and precise discrepancy reports are raised. All discrepancies should be based on sound and objective evidence.

#### Stage 3: Audit Reporting

- Audit reporting deals with the recording of any non-conformity and summarizing the audit findings.
- Audit report may contain:
  - o Observations of non-conformities,
  - o suggestions for corrective actions
  - o Identification of the reference documents against which audit is conducted (Quality system standard), company's quality manual etc.

#### Stage 4: Audit Follow-up

- The auditor is responsible only for identifying the non-conformity. But the auditee is responsible for determining and initiating corrective action needed to correct a non-conformity.
- corrective actions and subsequent follow-up should be completed within a time period

**5. What is the role of senior management commitment in the implementation of quality systems (May/June 2014)**

**Implementation steps**

**Step 1: Top management commitment**

The most important step in implementing a quality stem is to get the full support of upper management.

The top management must be willing to commit the resources necessary to achieve certification.

**Step 2: Appoint the management representative**

- This step is the Appointment of a management representative. The representative can be a member of the top management group.
- Management representative is responsible for coordinating the implementation and maintenance of the quality system.

**Step 3: Awareness**

- The next step is to create awareness about the ISO 9000 QMS.
- Since implementation of the quality system requires involvement of all members in the organization, the members should understand the process and implications of ISO program.

**Step 4: Appoint an implementation team**

- Now the implementation team should be formed
- This team should be drawn from all levels and areas of the organization.
- The team should identify the QMS processes and their sequence and interaction

**Step 5: Training**

- The implementation team, supervisors and internal audit team should be trained
- This activity can be accomplished through in-house training programs, seminars ,workshops, etc.

**Step 6: Time schedule**

- This activity develops a time schedule for the implementation and registration of the system
- This time frame will vary, depending on the size and type of the organization,

**Step 7: Select element owners**

- The implementation team selects owners for each of the system elements. Many of these owners for each of the system elements. Many of these owners will be members of the implementation team
- Each owners has the option of selecting a team to assist in the process

**Step 8: Review the present system**

- A review of the present quality system should be performed.
- Copies of all the quality manuals, procedures, work instructions and forms presently in use are obtained

**Step 9: Write the document**

- Written quality policy and procedure manuals should be prepared.
- This documentation of work instructions should be done by the employee who performs the job.

**Step 10: Install the new system.**

- The policies , procedures and work instructions should be integrated into the day-t-day working of the organization.
- Now the new system is installed

**Step 11: Internal audit**

- An internal audit of the quality system should be conducted
- This step ensures that the system is working effectively and to provide management with information for the comprehensive management review.

**Step 12: Management review**

- The management review should be conducted in order to determine the effectiveness of the system in achieving the stated quality goals

**Step 13: Pre-assessment**

- It is an optional step. If a good job is done on the previous steps ,then preassessment is not necessary.

**Step 14: Registration**

- The registration activity includes: choosing a registrar, Submitting an application and conducting the registrar's system audit.

- While choosing a registrar, one should consider so many factors such as cost, lead time, customer's acceptance of the registrar, the registrar's accreditation, and familiarity with the industry.

**Step 15: Award of ISO 9000 certificate:**

- After accepting the application and setting a time frame for registration, the registrar will review the quality system documentation.



**Question Paper Code : 31058**  
**B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013**  
**Seventh Semester**  
**Mechanical Engineering**  
**GE2022-TOTAL QUALITY MANAGEMENT**

**Part A**

1. List any four dimensions of Quality.
2. Mention the barriers involved in TQM implementation.
3. Differentiate between Empowerment and Delegation.
4. List the key element of supplier partnering.
5. State the principle of Pareto analysis.
6. What are the stages of six sigma?
7. What is quality circle?
8. How will you calculate OEE?
9. Specify the objective of Quality policy.
10. What are the objectives of ISO Standards?

**Part B**

11. a(i) Write the fourteen steps of Deming's philosophy for improving quality, productivity and competitiveness **Refer IQA: Page No: 13-14**  
(ii) What are quality statements? Explain with examples **Refer IQA: Page No: 19-20**  
(or)  
b(i) Explain in detail Juran's quality planning road map. **Refer IQA: Page No: 14-17**  
(ii) Review the history of TQM Chronologically. **Refer IQA: Page No: 17-18**
12. a(i) Discuss the roles to be played by the employees for an effective implementation of KAIZEN.  
(ii) Explain key elements of customer supplier partnership.  
(or)  
B(i) Briefly explain the continuous process improvement.  
(ii) Explain the roles of team leader and a facilitator.
13. (a) Explain any two tools of seven statistical tools with an example.  
**Refer IQA: Page No: 48**  
(ii) Discuss the role of six sigma in service sectors. **Refer IQA: Page No: 62**  
(or)  
(B)(i) What are the reasons for Benchmarking? Explain the six important steps in process of Benchmarking. **Refer IQA: Page No: 69-73**  
(ii) Define FMEA. Discuss the two types of FMEA. **Refer IQA: Page No: 59**
14. (a) (i) What are the objectives of TPM? Explain the five pillars of TPM.  
**Refer IQA: Page No: 69**  
(ii) Brief six basic techniques of presenting performance measures.  
**Refer IQA: Page No: 77**  
(or)  
(b) (i) What are the objectives of QFD? Discuss on four phases of QFD Process.  
**Refer IQA: Page No: 65**  
(ii) Explain Taguchi loss function and the evaluation method of the loss developed by him.  
**Refer IQA: Page No: 75**
- 15 (a) (i) Explain Quality Audit in detail. **Refer IQA: Page No: 106**  
(ii) Discuss the main elements of ISO 14000 **Refer IQA: Page No: 97**  
(or)  
(b) What are the barriers for implementing TQM in an Industry? Explain. **13**

Question Paper Code : 31549

**B.E/B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013**  
**Seventh Semester**  
**Mechanical Engineering**  
**GE2022-TOTAL QUALITY MANAGEMENT (Common to Mechanical**  
**Engineering (Regulations 2009/10)**

**Time: Three Hours**

**Maximum : 100 Marks Part A**

1. What are the dimensions of service quality?
2. What is the concept of Total Quality Management?
3. What are the different types of quality statements?
4. What is 5S?
5. What are the factors that distinguish six sigma concepts from traditional quality management concepts?
6. What is meant by Failure Mode and Effect Analysis?
7. What are the functions of Quality circle?
8. Define TPM.
9. What are the benefits of ISO 9000 Certification?
10. What is internal quality audit and external quality audit?

**Part B**

- 11(a).(i) What are the barriers while implementing TQM? (8)  
**Refer IQA: Page No: 13**
- (ii). Define. Quality. Explain the evolution of Quality(8) **Refer IQA: Page No: 17**  
(or)
- (b). Explain the Deming's fourteen points on route to quality. (16)  
**Refer IQA: Page No: 13-14**
- 12(a)i) Explain PDSA Cycle. **Refer IQA: Page No: 30-32** (8)
- (ii). What is a team? Describe the characteristics of a successful team (8)  
**Refer IQA: Page No: 34-35**  
(or)
- (b). Explain the various techniques of performance measures (16)  
**Refer IQA: Page No: 77-80**
- 13(a). What three different outcomes can benchmarking studies reveal? What course of action is appropriate for each outcome? (16)  
(or)
- (b). Explain the new seven tools of Quality management. **Refer IQA: Page No:45**
- 14(a). Explain the various types of costs contributing to the cost of quality. Give examples for each (16) **Refer IQA: Page No:24-27**  
(or)
- (b). Discuss in detail how the voice of customer is transformed into technical and functional requirements by QFD. (16) **Refer IQA: Page No: 65**
- 15(a). Discuss the various elements of ISO 9000-2000 Quality systems. (16)  
**Refer IQA: Page No: 88**  
(or)
- (b). (i) What is QS 9000? State its significance. (8) **Refer IQA: Page No: 105**  
(ii). What are the benefits of ISO 14000 Certification? (8)

Question Paper Code : 91505

B.E/B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER  
2014 Seventh Semester

Mechanical Engineering

GE2022-TOTAL QUALITY  
MANAGEMENT (Common to  
Mechanical Engineering (Regulations  
2009/10)

**Part-A**

1. What are the advantages of implementing TQM in manufacturing sector?
2. What are the elements of TQM?
3. What is meant by customer retention?
4. What is supplier partnering?
5. What is the use of prioritization matrices?
6. What is scatter diagram?
7. State the significance of quality circles.
8. What performance measures would you suggest for airline passenger service?
9. Explain briefly the environmental Management Systems.
10. What is ISO 9000 standard.

**Part-B**

11(a).(i) What is service quality. Explain its various elements towards customer satisfaction?(10)

What are the obstacles to implement to TQM? Explain.(6)

(or)

(B). Describe the Deming's 14 Principles to improve quality. (16)

12(a). (i) Discuss about three quality statements with example. (6)

(ii) What are the benefits of employee involvement? (6)

(iii) Explain briefly how employee involvement relate to employee empowerment?(4)

(Or)

(i) What is Team. List the characteristics of team (10)

(ii) Discuss the factors involved in Kaizen for continuous improvement (6)

13(a). Six Sigma concept can be applied to non manufacturing process. Do u agree with the statement ? Discuss (10)

(ii). Illustrate Cause and effect diagram with example (6)

(or)

(b) (i). What is Tree diagram. How it is useful for quality management (10)

(ii). What is critical success factor? How it is important in benchmarking (6)

14(a). Explain QFD with an example. (16)

(or)

(b). (i) List and explain various measures of performance in evaluating in success of an org(10)

(ii) Dicsuss the need for Taquchi Quality Loss function (6)

15(a)(i) Discuss 4 important documents prepared for ISO Certification (10)

(ii) What are the benefits for implementing ISO 14000 (6)

(or)

(b). Discuss various elements of ISO 9000:2000 quality systems. (16)

Question Paper Code : 21637

**B.E/B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015**  
**Seventh Semester**  
**Mechanical Engineering**

**GE2022-TOTAL QUALITY MANAGEMENT**  
**(Common to Mechanical Engineering**  
**(Regulations 2009/10)**

**Part A**

1. How is quality defined? Give any 2 definitions.
2. Compare quality requirements before and after TQM.
3. What are the traits of successful leaders?
4. What is strategic Quality planning?
5. How is scatter diagram used?
6. What are the reasons for benchmarking?
7. What sparked the interest of Indian manufacturers in quality circles?
8. What is the importance of Taguchi quality loss function?
9. what are the items covered by ISO 9000 in quality.
10. Write short notes on ISO certification.

**Part-B**

- 11(a). (i) what are the basic concepts of TQM? Discuss (8)  
What is TQM Framework? Discuss in detail (8)  
(or)
- (b) i) Discuss the contributions of Juran for Quality. (8)  
(ii) What are the barriers to implement TQM (8)
- 12(a). What are the various avenues of measuring customer satisfaction ? give example (8)  
(or)
- (b) (i). HOW is PDCA cycle prepared? Give an example. (8)  
(ii) what is meant by vendor development ? give an example. (8)
- 13(a). How are the following tools used to improve quality.  
(i) Tree Diagram (ii) Matrix diagram (8)  
(or)
- (b). (i) Discuss benchmarking process with an example (8)  
(ii) What are the types of FMEA? Give an example. (8)
- 14(a). How QFD is applied to handle Domestic iron box. Discuss with House of Quality. (8)  
(or)
- (b). What are the pillars of TPM. Discuss them in detail. (8)
- 15(a). Discuss the following  
(i) Documentation (ii) Quality Auditing (8)  
(or)
- (b). (i) What are the origins of QS 9000? Why was it developed despite of presence of ISO 9000? (8)  
(iii) What is environmental system ? Discuss the provisions of ISO 14000 (8)

Question Paper Code : 80508

**B.E/B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016  
Seventh Semester**

**Mechanical Engineering**

**GE6757-TOTAL QUALITY MANAGEMENT  
(Common to Mechanical Engineering  
(Regulations 2013)**

**Part A**

1. What are the different ways to create customer oriented culture in an industry.
2. Write the categories of Quality cost.
3. Write the requirements of reliable supplier rating.
4. How employee involvement can be improved in a organization?
5. What are the different ways of Bench marking?
6. How cause and effect diagram used in TQM.
7. Write the specific use of NP chart.
8. Define process capability index?
9. Name any two generic ISO standards. Why it is called generic standards?
10. What are core elements of QMS?

**Part B**

11. a. i. Write the underlying principles of TQM. (8)  
ii. Describe the various dimensions of Quality. (8)  
OR  
b.i. Explain the roles of senior level management in TQM implementation.(10)  
ii. Illustrate the various steps involved in customer satisfaction process. (6)
12. a. i. Give a detailed note on PDCA cycle. (8)  
ii. Portray the characteristics of Empowered Employees. (8)  
OR  
b.i. What is supplier partnering? Indicate its important benefits. (8)  
ii. Explain the step by step procedure in strategic quality planning. (8)
13. a. i. List the seven new management tools. Explain them briefly. (8)  
ii. Discuss about the various stages in Failure mode and effect analysis. (8)  
OR  
b.i. Compare six sigma and TQM concepts. (10)  
ii. What benefits have been achieved by the organizations that have successfully completed their bench marking programmes? Name any four selected best practiced companies. (6)
14. a.i. Describe the basic structure of house of quality, a primary planning tool used in QFD. (6)  
ii. Explain the difference between X-bar and R- charts. How can they be used together and why would it be important to use them together. (10)  
OR  
b.i. Describe quality control chart and how it can be used. What are the upper and lower control limits? What does it mean if an observation falls outside the control limits. (10)  
ii. Illustrate the key characteristics of Six sigma. (6)
15. a. Explain about the various processes used in ISO 9001 quality management systems. (16)  
OR  
b. With the help of flowchart explain the various divisions of ISO 14000 standard. (16)

Question Paper Code : 71949

**B.E/B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017**  
**Sixth/ Seventh/Eighth Semester**

**Mechanical Engineering**

**GE6757-TOTAL QUALITY MANAGEMENT'**  
**(Common to Mechanical Engineering)**  
**(Regulations 2013)**

**Part A**

1. What are the four absolutes of quality defined by Crosby?
2. Define quality policy statements.
3. What is Kaizen philosophy?
4. Why team and team work are required in TQM?
5. Mention the use of Stratification chart in TQM.
6. State the primary objectives of six sigma.
7. Write the key concepts of six sigma.
8. List out the benefits of total productive maintenance.
9. What are the important requirements of QS9000?
10. Mention the different types of quality audits.

**Part B**

11. a. Elaborate the fourteen steps involved in Crosby's total quality approach. (16)  
OR  
b.i. Describe the various dimensions of quality with respect to the following: (8)  
quality in products and quality inservices.  
ii. Explain the common customer feedback collection tools. (8)
12. a. i. Enumerate the duties of quality council. (8)  
ii. Explain McGregor's theory X and theory Y. (8)  
OR  
b.i. What do you understand by the term quality statements? Elaborate them with examples. (16)
13. a. Why benchmarking is required in an organization? Illustrate the different types of bench marking processes. Write down the general procedure for bench marking process. (16)  
OR  
b. List out different situations where FMEA is to be carried out. Give detailed FMEA procedure. (16)
14. a. Write down the objectives of implementing total productive maintenance. Discuss about the core elements of TPM program. Compare TQM and TPM. (16)  
OR  
b. i. List out the benefits of performance measures. (8)  
ii. Briefly explain the DMAIC procedure. (8)
15. a. Enumerate the various aspects of ISO 14000 environmental management system. Brief the various principles of ISO 14000 series. (16)  
OR  
b. Illustrate the detailed procedure for quality auditing. Brief the attributes of a good auditor. (16)