15BEME801 TOTAL QUALITY MANAGEMENT 3 0 0 3 100

OBJECTIVE

1. To facilitate the understanding of Quality Management principles and process.

UNIT I ESSENTIALS OF TQM 9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs – Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II TQM PRINCIPLES 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT III TQM TOOLS 9

The new seven management tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma – APQP.

UNIT IV TQM TECHNIQUES 9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

UNIT V QUALITY AND ENVIRONMENT SYSTEMS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2002 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 and ISO 18001 – Concept, Requirements and Benefits.

TOTAL 45 PERIODS

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Dale H.Besterfiled	Total Quality Management	Pearson Education, Delhi	2011

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Feigenbaum.A.V	Total Quality Control	McGraw Hill, New Delhi	2004
2	Oakland.J.S	Total Quality Management	Butterworth – Hcinemann Ltd., Oxford	2003
3	Narayana V. and Sreenivasan N.S	Quality Management – Concepts and Tasks	New Age International Ltd., New Delhi	2007
4	Zairi	Total Quality Management for Engineers	WoodHead Publishers, New Delhi	1996

WEB REFERENCES:

1. http://auciello.tripod.com/14tqm.html
2. http://www.fkm.utm.my/~shari/download/toc%20paper%20hilma%20tqm%20dis06.pdf
3. http://www.businessgyan.com/node/5409
4. http://www.accelper.com/pdfs/SS_Measurements_Concepts.pdf
5. http://tutor2u.net/business/strategy/benchmarking.htm
6. http://www.trst.com/iso2a.htm

KARPAGAM ACADEMY OF HIGHER EDUCATION

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FACULTY OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE PLAN

Subject Name : **TOTAL QUALITY MANAGEMENT**

Subject Code : **15BEME801** **(Credits - 3)**

Name of the Faculty : **DR. R. SIVAPRAKASAM**

Designation : **ASSISTANT PROFESSOR**

Year/Semester/Section : **IV YEAR / VIII Semester/ B Section**

Branch : **MECHANICAL ENGINEERING**

Sl. No.	Lecture Duration (Hr)	Topics to be Covered	Support Materials
		UNIT I - ESSENTIALS OF TQM	
1.	1	Introduction about TQM Subject.	**T[1], W[1]**
2.	1	Definition of Quality.	**T[1]**
3.	1	Dimensions of Quality, Quality Planning	**T[1]**
4.	1	Quality costs and types.	**T[1], R[4]**
5.	1	Analysis Techniques for Quality Costs	**T[1]**
6.	1	Basic concepts of TQM	**T[1]**
7.	1	Historical Review and Principles of TQM	**T[1], W[1]**
8.	1	Leadership and Role of Senior Management	**T[1]**
9.	1	Quality Council, Quality Statements, Strategic Planning	**T[1]**
10.	1	Deming Philosophy, Barriers to TQM Implementation	**T[1]**
11.	1	**Tutorial-1: Quality Costs**	**T[1]**
Total no. of Hours planned for unit - I			**11**

Sl. No.	Lecture Duration (Hr)	Topics to be Covered	Support Materials
		UNIT II - TQM PRINCIPLES	
12.	1	Customer satisfaction – Customer Perception of Quality, Complaints, Services quality	**T[1]**
13.	1	Customer Retention, Employee Involvement – Motivation	**T[1]**
14.	1	Empowerment, Team building	**T[1], W[1]**
15.	1	Recognition and Reward	**T[1]**
16.	1	Performance Appraisal and Benefits and benefits of organization	**T[1]**
17.	1	Continuous Process Improvements and implement task.	**T[1]**
18.	1	Juran Trilogy, PDSA Cycle, 5S, Kaizen Concepts	**T[1], R[4]**
19.	1	Performance Measures/ KPIS	**T[1], W[1]**
20.	1	Basic Concepts , Strategy, Performance Measure	**T[1]**
21.	1	**Tutorial-2: Performance Measures**	**T[1]**
Total no. of Hours planned for unit - II			**10**

Sl. No.	Lecture Duration (Hr)	Topics to be Covered	Support Materials
UNIT III - TQM TOOLS			
22.	1	The seven management tools of quality	**T[1], W[1]**
23.	1	Statistical Fundamentals	**T[1]**
24.	1	Measures of central Tendency and Dispersion,	**T[1]**
25.	1	Population and Sample	**T[1], R[4]**
26.	1	Normal Curve structure	**T[1]**
27.	1	Control cycle Charts for variables and attributes.	**T[1]**
28.	1	Process capability study	**T[1], W[1]**
29.	1	Concepts of six sigma quality	**T[1]**
30.	1	Advanced product quality plan APQP	**T[1]**
31.	1	**Tutorial-3: Process Capability& Control Charts**	**T[1]**
Total no. of Hours planned for unit - III			**10**

Sl. No.	Lecture Duration (Hr)	Topics to be Covered	Support Materials
UNIT IV - TQM TECHNIQUES			
32.	1	Benchmarking, Bench marking Reasons	**T[1]**
33.	1	Benchmarking Process	**T[1]**
34.	1	Quality Function Deployment	**T[1]**
35.	1	House of Quality- Construction with case study.	**T[1], W[1]**
36.	1	QFD Process and Significance	**T[1]**
37.	1	Quality Loss Function – Taguchi method of analysis.	**T[1]**
38.	1	Total Productive Maintenance (TPM)	**T[1], W[1]**
39.	1	TPM concepts, Improvement needs OEE - calculations	**T[1]**
40.	1	FMEA – concepts and Stages, work sheet practice	**T[1], R[4]**
41.	1	**Tutorial-4: Quality Loss**	**T[1]**
Total no. of Hours planned for unit - IV			**10**

Sl. No.	Lecture Duration (Hr)	Topics to be Covered	Support Materials
UNIT V - QUALITY AND ENVIRONMENT SYSTEMS			
42.	1	Need for ISO 9000 Quality and other quality Systems	**T[1]**
43.	1	ISO 9000:2000 Quality System and elements.	**T[1], W[1]**
44.	1	Implementation of Quality system	**T[1]**
45.	1	ISO Documentation methods)	**T[1]**
46.	1	Quality auditing (Internal & External	**T[1], R[4]**
47.	1	ISO TS 16949 – Concepts, elements, Requirements and benefits	**T[1], W[1]**
48.	1	ISO 1400– Concepts, elements, Requirements and benefits	**T[1]**
49.	1	ISO 18001– Concepts, elements	**T[1], W[1]**
50.	1	Requirements and benefits of ISO 18001	**T[1]**

51.	1	**Tutorial-5: Auditing on Documentation in Industry**	**T[1]**
52.	1	Question bank revision	QB
Total no. of Hours planned for unit - V			**11**

TOTAL PERIODS : 52

Text Books : [1] Dale H.Besterfiled, Total Quality Management, Pearson Education, Inc. 2011

Reference Books : [2] Feigenbaum.A.V, Total Quality Control, McGraw Hill, New Delhi, 2004
[3] Oakland.J.S, Total Quality Management, Butterworth – Hcinemann Ltd., Oxford, 2003
[4] Narayana V. and Sreenivasan N.S, Quality Management – Concepts and Tasks New Age International Ltd., New Delhi 2007
[5] Zairi, Total Quality Management for Engineers , WoodHead Publishers, New Delhi , 1996

Website :

1. http://auciello.tripod.com/14tqm.html
2. http://www.fkm.utm.my/~shari/download/toc%20paper%20hilma%20tqm%20dis06.pdf
3. http://www.businessgyan.com/node/5409
4. http://www.accelper.com/pdfs/SS_Measurements_Concepts.pdf
5. http://tutor2u.net/business/strategy/benchmarking.htm
6. http://www.trst.com/iso2a.htm

UNIT	Total No. of Periods Planned	Lecture Periods	Tutorial Periods
I	**11**	**10**	**1**
II	**10**	**9**	**1**
III	**10**	**9**	**1**
IV	**10**	**9**	**1**
V	**11**	**10**	**1**
TOTAL	**52**	**47**	**5**

I. CONTINUOUS INTERNAL ASSESSMENT : 40 Marks

(Internal Assessment Tests: 30, Attendance: 5, Seminar: 5)

II. END SEMESTER EXAMINATION : 60 Marks

TOTAL : 100 Marks

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FACULTY OF ENGINEERING

DEPARTMENT OF AERONAUTICAL ENGINEERING

TOTAL QUALITY MANAGEMENT

LECTURE NOTES

“Quality is not an act, it is a habit” - Aristotle

Quality Gurus

TOTAL QUALITY MANAGEMENT

UNIT I INTRODUCTION

Definition of quality – Dimensions of quality – Quality planning – Quality costs – Analysis techniques for quality costs – Basic concepts of total quality management – Historical review – Principles of TQM – Leadership – Concepts – Role of senior management – Quality council – Quality statements –Strategic planning – Deming philosophy – Barriers to TQM implementation.

UNIT II TQM PRINCIPLES

Customer satisfaction – Customer perception of quality – Customer complaints – Service quality

–Customer retention – Employee involvement – Motivation, empowerment, teams, recognition and reward – Performance appraisal – Benefits – Continuous process improvement – Juran trilogy – PDSA cycle – 5S – Kaizen – Supplier partnership – Partnering – Sourcing – Supplier selection – Supplier rating – Relationship development – Performance measures – Basic concepts – Strategy –Performance measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC)

The seven tools of quality – Statistical fundamentals – Measures of central tendency and dispersion – Population and sample – Normal curve – Control charts for variables and attributes – Process capability – Concept of six sigma – New seven management tools.

UNIT IV TQM TOOLS

Benchmarking – Reasons to benchmark – Benchmarking process – Quality Function Deployment(QFD) – House of quality – QFD process – Benefits – Taguchi quality loss function

– Total Productive Maintenance (TPM) – Concept – Improvement needs – FMEA – Stages of FMEA.

UNIT V QUALITY SYSTEMS

Need for ISO 9000 and other quality systems – ISO 9000:2000 Quality system – Elements – Implementation of quality system – Documentation – Quality auditing – TS 16949 – ISO 14000 –Concept – Requirements and benefits.

TEXT BOOKS

1. Besterfiled, D.H. “Total Quality Management”, Pearson Education, Inc. 2003.
1. Zeiri., “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

REFERENCES

2. Evans, J. R., and Lidsay, W.M., “The Management and Control of Quality”, 5th Edition, South-Western (Thomson Learning), 2002.
3. Oakland.J.S. “Total Quality Management”, Butterworth – Hcinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan, N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.

UNIT I - INTRODUCTION TO QUALITY MANAGEMENT

Total quality management is a management's approach towards the quality, it can be in regard to products, customer satisfaction and employees satisfaction. The concept of TQM was developed by an American W. Edwards Deming..He introduced this concept for improving the quality of various products and services.

TQM works on one belief that mistakes can be avoided and defects can be prevented. And management should believe in watching each and every step.TQM talks about the satisfaction of customer, supplier, employees etc. and it requires continuous improvement. If the workers of an organization are efficiently working then their morale will go up. TQM works effectively if the organization works in a family manner.

Total quality management is called total because entire organization is involved, Quality means degree of excellence. And management in literal sense means getting things done by others. In a TQM effort, all members of an organization participate in improving processes, products, services and the culture in which they work. The earlier introduced quality management concept is now taken over by Total quality management. To have effective TQM the first requirement is strong internal motivation and emotional involvement for implementation. So the concept of TQM talks about adopting the new policy, creating quality products, eliminate defects, estimate for breakdown, accidents etc . Hence TQM should be purpose driven so first the whole organization should be willing to accept the change then only TQM can actually affect the organization in a positive way.

QUALITY:

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

DEFINITIONS OF QUALITY:

(i) Quality is defined as the predictable degree of uniformity and dependability, at low cost suited to the market. – **Deming**

(ii) Quality is defined as fitness for use - **Juran**

(iii) Quality is defined as conformance to requirements - **Crosby**

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(iv) Quality is totality of the characteristics of entity that bear on its ability to satisfy stated and implied needs - **ISO**

DIMENSIONS OF QUALITY

Quality has nine different dimensions. Table shows these nine dimensions of quality with their meanings and explanations in terms of a cell phone.

S.No.	Dimension	Meaning and Example
1.	Performance	Primary operating characteristics of a product, such as signal coverage, audio quality, display quality, etc.
2.	Features	Secondary characteristics, added features, such as calculators, and alarm clock features.
3.	Conformance	Meeting specifications or industry standards, workmanship (or) the degree to which a product's design or operating characteristics match pre-established standards.
4.	Reliability	The probability of a product's failing within a specified period of time.
5.	Durability	It is a measure of product's life having both economic and technical dimensions.
6.	Service	Resolution of problem and complaints, ease of repair.
7.	Response	Human to human interface, such as the courtesy of the dealer.
8.	Aesthetics	Sensory characteristics, such as exterior finish.
9.	Reputation	Past performance and other intangibles, such as being ranked first.

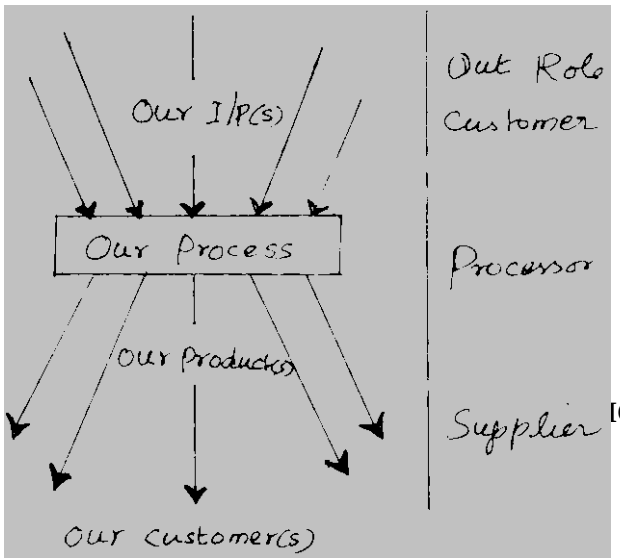
QUALITY PLANNING:-

Quality planning attempts to meet the quality needs of the customers. In order to meet these customer needs a **quality planning road map** can be prepared, as shown in Fig.

a) The road map consists of structured and sequential steps.
b) Output of each preceding activity or step becomes the input for the next step and so on.
c) This quality planning road map is applicable to all industries in both the manufacturing and service sectors. It is applicable at all levels in an organization, such as corporate, division, department, job and in all functional areas such as marketing, finance, production / operations and human resources.

The quality planning road map can be applied at the following levels:

i) Supervisory and worker level
ii) Functional level
iii) Multifunctional systems, and
iv) Major programmes.



ELEMENTS OF QUALITY COSTS

The cost of quality (COQ) can be classified into the following four categories.

- Cost of prevention
- Cost of appraisal
- Cost of internal failures, and
- Cost of external failures.

Cost of Prevention

- ***Prevention costs*** are the costs that are incurred on preventing a quality problem from arising.
- Prevention costs relate to efforts to prevent failures.
- ***Cost of prevention includes:***
- ***Cost of quality planning :*** It includes the costs associated with creating an overall quality plan, the cost of market research and product development, inspection plan, reliability plan, etc.
- ***Cost of documenting:*** It includes cost of preparation of required documents such as manuals, procedures, policies, etc.
- ***Process control cost:*** It is the cost associated with implementing the quality plans and procedures to achieve the stated 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.
- Cost of quality awareness programme.

Cost of Approval

a) ***Appraisal costs*** are the costs that are incurred in assessing that the products / services conform to the requirements.

b) Appraisal costs relate to testing, execution, and examination to assess whether specified quality is being maintained.

c) ***Cost of appraisal includes :***

a. Cost of receiving test and inspection.
b. Cost of laboratory acceptance testing.
c. Cost of installation testing.
d. Cost of installation and commissioning.
e. Cost of maintenance and calibration of testing and inspecting equipments.
f. Cost of test equipment depreciation.
g. Cost of analysis of reporting of tests and inspection results.
h. Cost of line quality engineering.

i. Cost of vendor rejects,

Cost of Internal Failures

- ***Internal failure costs*** arise due to internal failures.
- These costs are linked to correcting mistakes before delivery of the product, such as : scrap, rejects, adjustments, downtime of equipment, labour sitting idle while waiting for repairs, and sales discounts for inferior products.
- ***Cost of internal failure includes:***

1. Cost associated with scrap and rejects.
2. Cost of repair and rework.
3. Cost of design changes.
4. Cost of trouble-shooting or defect failure analysis.
5. Cost of reinspection and retesting.
6. Cost of sales discounts for inferior products.
7. Cost of downgrading.
8. Cost of downtime.

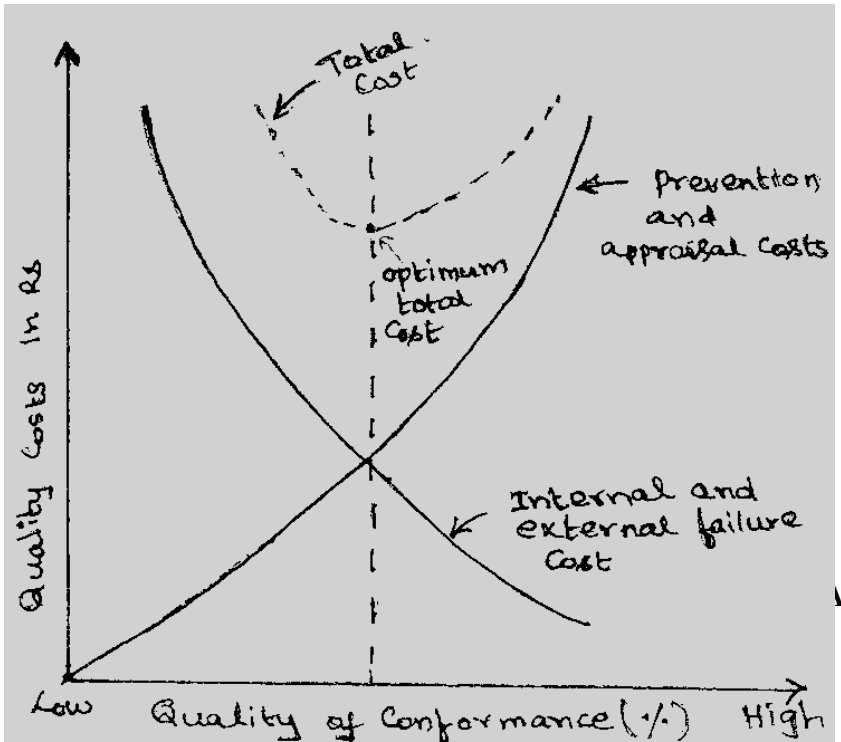
Cost of External Failures

1. ***External failure costs*** arise from the rejection of the products / services by the customers due to poor quality.
2. 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, lost goodwill of customer, guarantee and warranty costs, and dispatchment costs.

3. ***Cost of external failures include :***

1. Cost of processing complaints from customers.
2. Cost of commissioning failure.
3. Cost of servicing or replacing the defective items.
4. Cost of guarantee and warranty claims.
5. Cost of lost goodwill of customer.
6. Cost of product reliability compensation (voluntary or legal).
7. Cost of loss of sales.
8. Cost of concessions offered to customers (due to substandard products being accepted by customers).

OPTIMUM COST OF PERFORMANCE



The relationship between various cost categories is depicted in Figure. It is understood that the sum of the prevention and appraisal costs rises from zero to infinity as perfection is approached. Thus the optimum total cost

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point lie between two infinities, as shown in figure

From the figure, it is clear that to achieve a reduction in failure costs, it is necessary to increase prevention and appraisal costs.

4. Discuss the various Analysis techniques involved for Quality Costs.

ANALYSIS OF COQ FOR IMPROVEMENT

Management should use the COQ data to identify and prioritize improvement opportunities. The first priority is to eliminate external failures and then internal failures. Thereafter inspection can be reduced gradually. By spending more money on prevention all these can be achieved. A typical case study is given in Table.

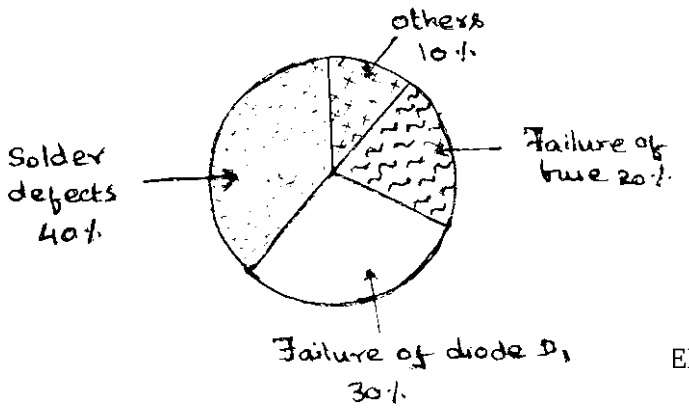
Cost of Quality as a Percentage of Total Manufacturing Cost

Year	External	Internal	Appraisal	Prevention	Total COQ
1995	3	1.5	1	0.5	6
1997	1.5	2.5	1.5	0.5	6
1999	0.5	1	1.5	1	4
2001	0.1	0.2	0.5	1.2	2

During 1997, increasing appraisal without increasing prevention increased internal failures but reduced external failures. However, the total COQ did not change. This is certainly an improvement because external failures affect business very badly. During 1997, the organization decided to get into ISO 9000 and focus on prevention. During 1999 when prevention was stepped up, keeping the same level of inspection, the failures and overall COQ came down. In 1999, the CEO decided to adopt TQM. Vigorous efforts were made to improve quality further and do things right, the first time and every time. Hence in the year 2001, appraisal could be brought down drastically. However, the result is much better as the table indicates. Now both the internal failures and external failures are quite low. Efforts should be made in the same direction so that overall COQ reduces further. Thus, TWM is aimed at enabling the lowest cost of quality.

ANALYSIS OF EXTERNAL, FAILURE COST

Similarly an analysis of external failures was made by the organization. The pie chart below indicates the distribution of causes of external failure.



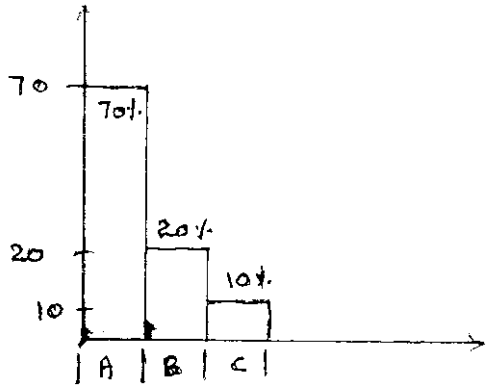
The above pie chart gives the priorities for action to be taken as given below:

1. Improve quality of soldering
2. Eliminate the cause of failure of diode D_1.
3. Estimate the correct rating of fuse and analyze the causes of failure of fuse.

If all the above failures can be eliminated then the failure cost will reduce to about 10 per cent.

ANALYSIS OF INTERNAL FAILURE COSTS

From the data available, the causes for the internal failure costs were analyzed and plotted as a Pareto Diagram.



1. Wrong component placed
2. Soldering failure
3. Other causes.

A major cause of internal failure was insertion of wrong components in the PCB. The process was studied and found that the lighting in assembly line needed improvement and the operators needed training. This analysis and the external failure analysis pointed to problems in the soldering process. A thorough study was required to reduce the defects caused by poor soldering.

Thus, it is very important to analyze the data more closely to derive benefits to the organization.

The COQ analysis gives the following benefits to the organization.

1. Brings out the magnitude of the quality problem in the organization. It further leads to establishing goals for the organization to improve quality.
2. Enables cost reduction owing to steps taken for improvement based on analysis.
3. Enables taking steps to improve customer satisfaction.
4. Displaying the results motivates employees to improve further.

TQM (TOTAL QUALITY MANAGEMENT):

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.

CHARACTERISTICS OF TQM

The above definitions revealed the following characteristics of TQM :

1. TQM is a customer oriented.
2. TQM required a long term commitment for continuous improvement of all processes.
3. TQM is a teamwork.
4. TQM requires the leadership of top management and continuous involvement.
5. TQM is a strategy for continuous improving performance at all levels and in all areas of responsibility.

BASIC CONCEPTS OF TQM

A successful TQM programme requires the following six basic concepts.

1. 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 newsletters. Also, top management should make sure that everybody within the organization from top to bottom is communicated about the TQM programme.

2. 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.

3. Effective involvement and utilization of the entire work force: This concept is sometimes referred as 'principle of employees involvement' or 'respect for people'. TQM is a team work. 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.

4. 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.

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

6. ***Establishing performance measures for the processes:*** As we know, 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.

ELEMENTS OF TQM

A framework summarizing the important elements of TQM discussed in this text.

Three elements of TQM include

1. The philosophical elements of TQM stress the operation of the company using quality as the integrating element.

2. The generic tools consist of various statistical process control (SPC) methods that are used for problem solving and continuous improvement by quality teams. Quality function deployment is typically used by managers to drive the voice of the customer into the organization.

3. Tools of the QC department consists of statistical quality control (SQC) methods such as sampling plans, process capability and Taguchi methods.

PRINCIPLES OF TQM

The important underlying principles of TQM are as follows:

1. Customers' requirements must be met the first time, every time.
2. There must be agreed requirements, for both internal and external customers.
3. Everybody must be involved, from all levels and across all functions.
4. Regular communication (both formally and informally) with staff at all levels is must. Two way communication at all levels must be promoted.
5. Identifying training needs and relating them with individual capabilities and requirements is must.
6. Top management's participation and commitment is must.
7. A culture of continuous improvement must be established.
8. Emphasis should be placed on purchasing and supplier management.
9. Every job must add value.
10. Quality improvement must eliminate wastes and reduce total cost.
11. There must be a focus on the prevention of problems.
12. A culture of promoting creativity must be established.
13. Performance measures is a must at organization, department and individual levels. It helps to assess and meet objectives of quality.
14. There should be focus on team work.

ROLE OF SENIOR MANAGEMENT

1. In practice, the TQM effort has been led by members of senior management. They provide the vision of where the company is heading with its quality effort. They lead in creating a cultural change within the company.
2. ***The responsibilities of senior management are:***

- ❖ To study and investigate the TQM concepts and issues.
- ❖ To set clear quality policies and provide challenging tasks.
- ❖ To establish 'priority of quality' and 'customer satisfaction' as the basic policy and determine the long term goals.
- ❖ To bring a cultural charge required for the TQM effort.
- ❖ To establish the TQM vision for the future and communicate to all involved.
- ❖ To become coaches and cheer leaders for encouraging and supporting the managers during the transition phase of the transformation change,
- ❖ To stimulate employee to be involved.
- ❖ To teach employees to realize that the company's interest and their interest are geared into one another.
- ❖ To uphold norms and values, and let it be known.
- ❖ To attend TQM training programmes.
- ❖ To create coordination and harmony among and within departments.
- ❖ To monitor whether quality improvement programs are conducted as planned.
- ❖ To create a basic of trust, respect and open communication, which ensures individual participation and continuous improvement.

BARRIERS TO TQM IMPLEMENTATION

(IMPEDIMENTS OR OBSTACLES TO TQM IMPLEMENTATION)

The various roadblocks in implementing TQM are:

- 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 techniques 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.

QUALITY COUNCIL

What is it?

1. ***A quality council*** is a team to provide overall direction for achieving the total quality culture (TQC).
2. ***The quality council is composed of :***

   a. The chief executive officer (CEO);
   b. The senior managers of the functional areas, such as design, marketing, finance, production, and quality; and
   c. A coordinator or consultant.

Duties of the Quality Council

The duties of the quality council are :

1. To establish the core values and quality statements. Quality statements include vision statement, mission statement, and quality policy statement.
2. To establish the strategic long-term plan with goals and the annual quality improvement program with objectives.
3. To plan the training and education programmes.
4. To determine and monitor the cost of poor quality.
5. To perform and monitor the performance measures for each functional areas of the organization.
6. To establish multifunctional project and departmental teams and monitor their progress.
7. To establish / revise the recognition and reward system periodically.

Responsibilities of the Quality Council Coordinator are

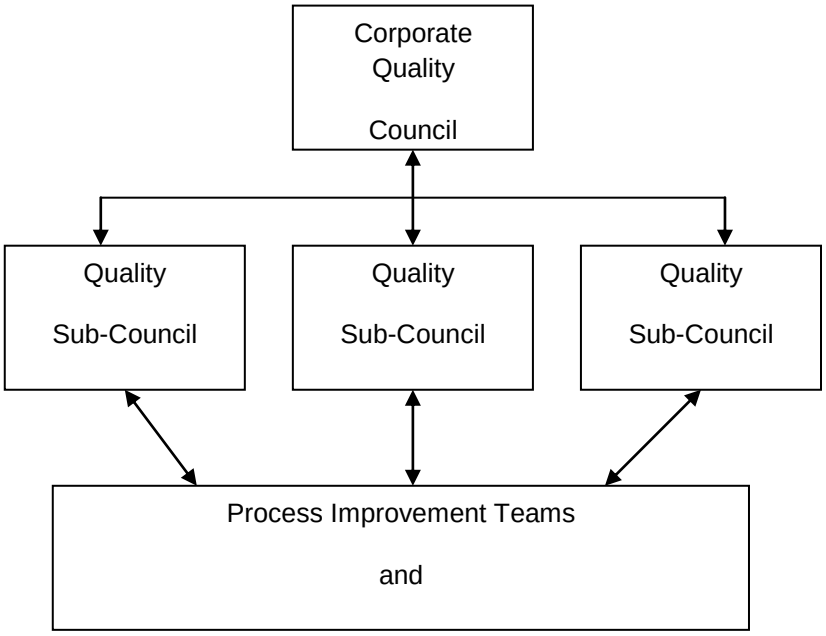
1. To develop two-way trust ;

2. To propose team requirements to the council;
3. To share council expectations with the team;
4. To empower the team; and
5. To brief the council on team progress.

Thus quality councils are the instruments for creating the idea of never-ending quality improvement. In other words, it is the driver for the TQM engine.

Quality Structure

Figure shows a typical quality structure involving different levels of cross-functional participation by managers.



Deming defines quality in terms of quality of design, quality of conformance and quality of the sales and service functions. Table summarizes his 14 principles on route to quality.

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 which ask for zero defects and new levels of productivity. Such exhortations only create adversarial relationships, since the bulk of the causes of low quality and low productivity belong to the system and thus lie beyond the power of the workforce.

11. Eliminate work standards (quotas) on the factory floor. Substitute leadership. Eliminate management by objectives. Eliminate management by numbers, numerical goals, substitute leadership.

12. Remove barriers to pride of workmanship. The responsibility of supervisors must be changed from sheer numbers to quality. Remove barriers that rob people in management and in engineering of their right to pride of workmanship. This means, for example, abolishment of annual or merit rating and of management by objectives.

13. Institute a vigorous program of education and self-improvement.

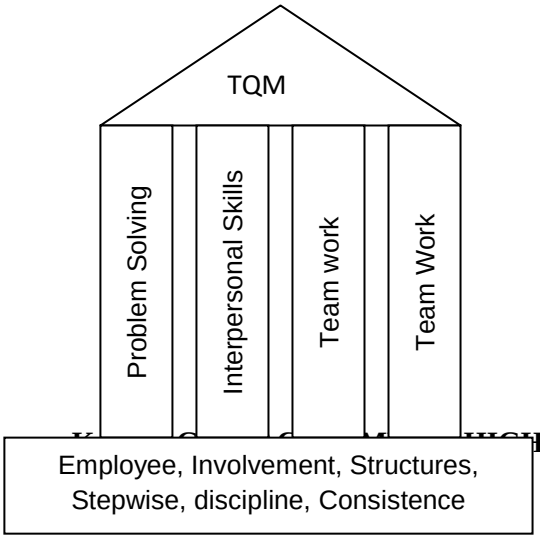
14. Put everybody in the company to work to accomplish the transformation. The transformation is everyone's job.

Different Views of Quality

1. ***From the user's point of view,*** quality is an expression of the products / services usefulness in meeting the needs and expectations and its reliability, safety, durability and so on.
2. ***From the production point of view,*** the quality of a product is measured by the quality of its performance which depends on the quality of design and the quality of conformance.

PILLARS OF TQM

Figure depicts the four pillars of the TQM-house.



The four pillars of TQM are :

1. Problem solving discipline,
2. Interpersonal skills,
3. Teamwork, and
4. Quality improvement process.

TQM is used to improve the whole organization stepwise, structured and systematically according to hard work, discipline, intensive training, and consistent implementation of techniques and resources. These quality principles form the ***foundation*** of TQM, as shown in Figure.

POTENTIAL BENEFITS OF TQM

Table presents the tangible and intangible benefits of TQM.

Table – Benefits of TQM

Tangible Benefits	Intangible Benefits
1. Improved product quality	2. Improved employee participation
3. Improved productivity	4. Improved teamwork
5. Reduced quality costs	6. Improved working relationships
7. Increased market and customers	8. Improved customer satisfaction
9. Increased profitability	10. Improved communication
11. Reduced employee grievances	12. Enhancement of job interest.
	13. Enhanced problem-solving capacity.
	14. Better company image

LEADERSHIP

INTRODUCTION

The success of quality management is to a greater extent is influenced by the quality of the leadership. Peter Drucker, the eminent management thinker and writer quotes: “Leadership is lifting of man’s visions to higher sights, the raising of man’s performance to a higher standard, the building of man’s personality beyond its normal limitations”.

Leadership is the process of influencing others towards the accomplishment of goals. Leader triggers the will to do, show the direction and guide the group members towards the accomplishment of the company’s goal.

CHARACTERISTICS OR BEHAVIOURS OF QUALITY LEADERS

Successful quality leaders tend to demonstrate the 12 characteristics or behaviours. They are :

1. The customers first : Quality leaders give primary importance to both internal and external customers and their needs. Leaders should listen to customers; actively seek their opinion on the value

of the products / services ; develop a close link with customers ; seek joint improvement activity; and lead the handling of complaints.

2. Value people : Quality leaders take care of the development of people's skill and capabilities. They enable people to be responsible for the result of their work. They monitor, appraise and recognize people's performance.

3. Build supplier partnership: Quality leaders clarify quality to suppliers; audit their capabilities; give feedback; discuss improvements; and support them where needed. They recognize quality improvements made by suppliers and encourage joint improvement action.

4. Empower people : Quality leaders train and coach the people, rather than directing and supervising them.

5. Demonstrate involvement / commitment : Quality leaders continually demonstrate their commitment to quality.

6. Strive for excellence : Quality leaders emphasize continuous improvement rather than maintenance. They strictly believe the statement 'There is always room for improvement'.

7. Explain and deploy policy : Quality leaders explain the quality policy to all involved. They set stretching targets and deploy these to business processes, to the functions within the organization, and to suppliers.

8. Improve communication : Quality leaders continually improve communications. They establish channels of communication, which are reliable and accessible to everyone in the organization.

9. Promote teamwork: Quality leaders promote multidisciplinary teamwork ; create involvement; and active participation of everyone.

10. Benchmark continuously : Quality leaders learn from problems. They continuously do benchmarking and create new learning effects through innovation.

11. Establish system : Quality leaders establish organizational systems to support the quality effort.

12. Encourage collaboration : Quality leaders encourage collaboration rather than competition. They emphasize the importance of collaboration among and within functional areas, departments or work centres.

LEADERSHIP ROLES

Effective teamwork requires effective leaders. Effective leaders are people who can perform different roles. Quinn lists the following eight leadership roles:

1. Producer role ;	2. Director role ;
3. Coordinator role ;	4. Checker role ;
5. Stimulator role ;	6. Mentor role ;
7. Innovator role; and	8. Negotiator role

QUALITY STATEMENTS

Three elements of quality statements are :

a. Vision statement,
b. Mission statement, and
c. Quality policy statement

What is Vision Statement?

1. ***The vision statement*** is a short declaration of what on organization aspires to be tomorrow.
2. It is the ideal state that might never be reached; but on which one will work hard continuously to achieve. Successful visions provide a brief guideline for decision making.
3. The vision statement 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.
4. ***An example of a simple vision statement is :***
   "To continuously enrich knowledge base of practitioners in mobility industry and institutions in the service of humanity". – Society of Automotive Engineers (SAE)

What is Mission Statement?

1. The mission statement, describes the function of the organization. It provides a clear statement of purpose for employees, customers, and suppliers.
2. ***The mission statement*** answers the following questions : who we are?; who are our customers? ; what we do?; and how we do it?
3. ***An example of a simple mission statement is :***
   "Concern for the ultimate customers – millions of customers

   Concern for the intermediate customers – the trade

   Concern for the suppliers – the sources of raw materials and ancillaries

   Concern for the employees – the most valued asset

   Concern for the competitors – wishing them well as healthy competition ultimately benefits the customers.

   Concern for the shareholders – the investing public

   Concern for the national aspiration – India's future!"

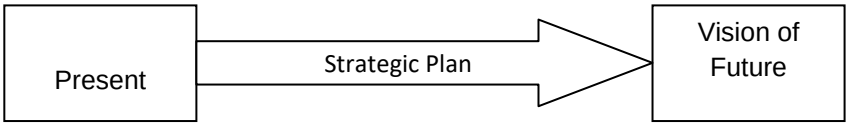
   - ITC Limited

What is 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.
It should be written by the CEO with feedback from the workforce and be approved by the quality council.
A quality policy is a important requirement of ISO 9000 quality systems.

An example of a simple quality policy statement is:

"Xerox is a quality company. Quality is the basic business principle for Xerox. Quality means providing our external and internal customers with innovative products and services that fully satisfy their requirements. Quality is the job of every employee".



- ***Strategic planning*** sets the long-term direction of the organization in which it wants to proceed in future. This is depicted in Figure.
- ***Definition :*** Strategic planning can be defined as the process of deciding on objectives of the organization, on changes on these objective, on the resource used to attain these objectives and on the policies that are to govern the acquisition, use and disposition of these resources".
- ***Examples of strategic planning*** in an organization may be : planned growth rate in sales, diversification of business into new lines, type of products to be offered, and so on.

STRATEGIC PLANNING PROCESS

(SEVEN STEPS TO STRATEGIC PLANNING)

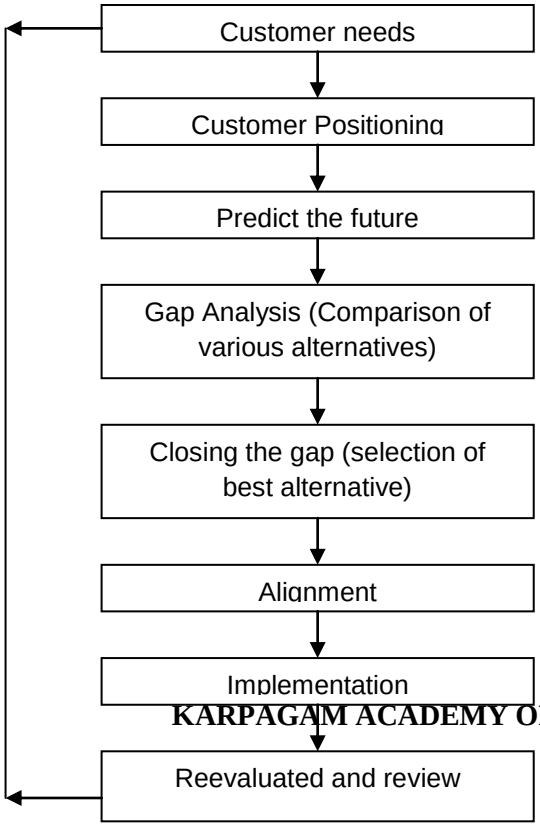
In order to integrate quality with the strategic planning process, a systematic and sequential procedure has to be adopted. There are seven basic steps to strategic process planning. They are

Step 1. Customer Needs

The basic step is the identification of customers and their wants and needs. An organization must seek its customers' requirements, expectations and assess future trends before developing a strategic plan.

Step 2. Customer Position

The second step 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

Next, 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

In this step, the planners must identify the gaps between the current state and the future state of the organization. This concept is also known as ***value stream mapping.*** For identifying the gaps, an analysis of the core values and concepts and other techniques may be used.

Step 5. Closing the Gaps

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

Step 6. Alignment

Now the revised plan should be aligned with the mission, 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

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.

Since quality is a continuous improvement process, one has to reassess and renew the strategic plans periodically. So it is a cyclic process. Figure summarizes the strategic planning cycle.

UNIT – II

TQM PRINCIPLES

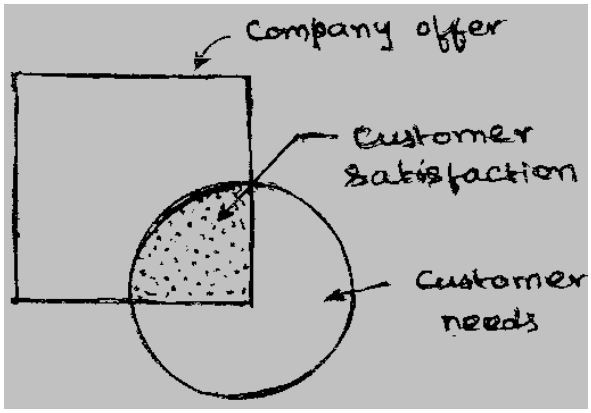
CUSTOMER SATISFACTION:

As emphasized so far, in today's buyers market 'the customer is the king'. Even the definition of quality, 'quality is what customer wants', emphasizes on the customer requirements. In other words, quality is a measure of customer satisfaction. It is obvious that business cannot survive without satisfied customers. Therefore 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 importance of the customer.

Customer Satisfaction Model

Figure shows the Teboul's model of customer satisfaction. In figure, the customers' needs are represented by the circle, and the square represents the product or service offered by the company. The intersection portion, shown with dots, is perceived as the customer satisfaction. So it is understood that the company should strive for increasing the intersection portion i.e. customer satisfaction.



WHO ARE THE CUSTOMERS?

The customers are :

1. The most important people in the business.
2. Not dependent on the organization. The organization depends on them.
3. Not an interruption to work but are the purpose of it.
4. Doing a favour when they seek business and not vice-versa.
5. A part of business, not outsiders.
6. Life blood of the business.
7. People who come with their needs and jobs.
8. Deserve the most courteous and attentive treatment.

Types of Customers

Customers are two types. They are :

1. Internal customers, and 2. External customers.

1. *Internal Customers*

1. The customers inside the company are called internal customers.
2. As there is a flow of work, product and service in the organization, each department is dependent on the other. In this, each department or each quality management unit is considered as a customer by the previous department and as a supplier for the next department. Similarly every person in a process is considered as a customer of the preceding operation. This explains the concept of internal customer.

2. External Customers

- The customers outside the company are called external customers.
- In other words, an external customer is the one:
- who uses the product or service ;
- who purchases the product or service; or
- who influences the sale of the product or service.

Customer – Supplier Chain

In order to achieve the total customer orientation, TQM requires the better customer – supplier relationship. Figure shows the model of customer – supplier chain.

All processes require inputs, which are provided by the internal or external suppliers. Similarly all processes delivers outputs, which are used by internal or external customers. Each unit is considered as a customer by the previous unit and as a supplier for the next unit.

CUSTOMER PERCEPTION OF QUALITY

Quality is what customer perceives it to be. However, as the customers go on changing their needs, the quality level needs are to be improved continuously to meet the customers demand. That's why the basic concept of TQM philosophy is continuous process improvement.

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

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

1. Performance

1. Performance involves "fitness for use". It indicates that the product and service is ready for the customers' use at the time of sale.
2. ***Other considerations include:***

a. ***Availability :*** It is the probability that a product will operate when needed,
b. ***Reliability :*** It is freedom from failure over time, and
c. ***Maintainability:*** It is the ease of keeping the product operable.

2. Features

(a) Features are secondary characteristics of the product or service.
(b) For example, the primary function of a cell phone is for communication, whereas other facilities such as calculator and alarm are features of the cell phone.

3. Service

(a) Customer service is an intangible in nature. Intangible characteristics are those traits that are not quantifiable, but it contributes greatly to customer satisfaction.
(b) Organizations objective is to provide good quality of the product to the customer at the right time, even though the customers are not complaining about their service.

4.Warranty

(a) The product warranty represents an organization's public promise of a quality product. In other words, it represents a public commitment to guarantee a level of service sufficient to satisfy the customer.
(b) A warranty forces the organization to focus on the customer's definition of product and service quality. It also forces the organization to develop a corrective action system.
(c) In present scenario, the warranty attracts and builds the market. It encourages customers to buy a service by reducing the risk of the purchase decision. Hence it generates more sales from existing customers by enhancing loyalty.

5. Price

1. Nowadays customer is willing to pay a higher price to obtain value. Also customers expect high quality products at the lower price.
2. Customers are preferring the organizations who are providing the greatest value for their money. For this purpose, customers are constantly evaluating all the organizations.
3. In our highly competitive environment, each customer's concept of value is continually changing. In order to overcome this challenge, the organizations should identify, verify and update each customer's perception of value in relation to each product and service regularly.

6. Reputation

1. It is obvious that customers are willing to buy products or service from a known, trusted and reputed organization. The total customer satisfaction is based on, not only with the product, the entire experience with the organization.
2. Thus reputation of a firm brings the market to them. So organization should strive for customers for life.

CUSTOMER FEED BACK

Customer feedback must be continually solicited and monitored. Customers continually change. They change their minds, their expectations, and their suppliers. Customer feedback is not a one-time effort; it is an ongoing and active probing of the customers' mind. Feedback enables the organization to:

Discover customer dissatisfaction.
Discover relative priorities of quality
Compare performance with the competition.
Identify customers' needs.
Determine opportunities for improvement.

Even in service industries, such as insurance and banking, customer feedback has become so important that it drives new product development. There are programs to identify and analyze errors, take corrective action, and make ongoing enhancements. All these efforts are justified when the consumers' expectation levels are very high. Effective organizations take the time to listen to the voice of the customer and feed that information back to the idea stage. For instance, listening to the voice of the customer changed how the Internal Revenue Service does business. Previously, IRS thought that good customer service was mailing tax forms out right after New Year's Day. Then, the IRS asked its customers what good customer service was. The IRS found out that the customers wanted fast refunds and very little contact with the IRS. Now, about 20 million taxpayers can forget using the 1040EZ form and file on their touch-tone phone. There is no contact with the IRS, it takes about six minutes, and the phone system does the math. Refunds are received within 21 days.

Listening to the voice of the customer can be accomplished by numerous information-collecting tools. The principal ones are comment cards, questionnaires, focus groups, toll-free telephone lines, customer visits, report cards, the Internet, employee feedback, mass customization and the American Customer Satisfaction Index.

Comment Card

A low-cost method of obtaining feedback from customers involves a comment card, which can be attached to the warranty card and included with the product at the time of purchase. The intent of the card is to get simple information, such as name, address, age, occupation, and what influenced the customer's decision to buy the product. However, there is very little incentive for buyers to respond to this type of card, and the quality of the response may not provide a true measure of customers' feelings. Generally, people respond only if something very good or very bad has happened. Comment cards are also used in the hospitality industry. Restaurants and hotels provide them at the ends of tables and in hotel rooms. They can even be found on the bottom of restaurant sales receipts. Often, free meals or hotel stays are provided to rectify a poor experience noted on a comment card. Free means and hotel stays can generate significant customer loyalty provided the organization also fixes the problem.

Customer Questionnaire

A customer questionnaire is a popular tool for obtaining opinions and perceptions about an organization and its products and services. However, they can be costly and time-consuming. Surveys may be administered by mail or telephone. In the form of questionnaires, the customer is asked to furnish answers relating to the quality of products and services. Most surveys ask the customer to grade the question on a one-to-five scale or a one-to-ten scale, where the highest number typically has a description like "highly satisfied". One of the reasons the one-to-five or one-to-ten scale is used is because it easily produces a metric. For example, the Spouse Satisfaction Survey.

Although the "1 to 5" scale is a typical approach to surveys, it probably is not entirely effective. It does not tell the surveyor how important trash removal is relative to other Customer focus groups are a popular way to obtain feedback, but they too can be very expensive. These groups are very effective for gathering information on customer expectations and requirements.

Highly **Highly**

Satisfied **Neutral** **Dissatisfied**

1. Trash removal	5	4	3	2	1
2. Personal hygiene	5	4	3	2	1
3. Lawn maintenance	5	4	3	2	1
4. Romance	5	4	3	2	1
5. Thoughtfulness	5	4	3	2	1
6. Listening skills	5	4	3	2	1
7. Faithfulness	5	4	3	2	1

Surveying a focus groups is a research method used to find out what customers are really thinking. A group of customers is assembled in a meeting room to answer a series of questions. These carefully structured questions are asked by a skilled moderator, who probes into the participants' thoughts, ideas, perceptions, or comments. The moderator has a clear understanding of the type of information wanted and a plan for obtaining it. Meetings are designed to focus on current, proposed, and future products and services. The people selected to participate have the same profile as the customers that the organization is trying to attract. As an incentive to participate, these people are reimbursed for their time. Focus groups are sometimes used with an organization's employees to examine internal issues.

Toll-Free Telephone Numbers

Toll-free (800/888) telephone numbers are an effective technique for receiving complaint feedback. Organizations can respond faster and more cheaply to the complaint. Such a number does not, however, reach those who decided not to buy the product or those who discovered some liable feature on a competitor's product. Toll-free numbers are in use by at least 50% of all organizations with sales of at least $10 million.

Implementation of toll-free telephone numbers has grown tremendously – in six years, the Cadillac division of General Motors added 24 toll-free numbers. In response to what customers said, Cadillac eliminated deductibles on warranties and pioneered 24-hour roadside service.

Customer Visits

Visits to a customer's place of business provide another way to gather information. An organization can proactively monitor its product's performance while it is in use and thereby identify any specific or recurring problems. Senior managers should be involved in these visits and not delegate them to someone else. However, it is a good idea to take along operating personnel so they can see firsthand how the product is performing. One site visit L-S Electro Galvanizing Company made to its customer, General Motors, produced a surprisingly simple idea. An arrow was needed on the finished 25-ton rolls of steel to show which way the steel unrolled. Previously, GM employees had to guess and often times had to resummon a crane to turn the roll around, which wasted 30 minutes. [14] Another example of a productive customer visit is when U.S. Steel sent an hourly worker, who applied anti-corrosion coating, to the Ford auto plant that used their steel. The worker found flaking zinc and knew there was too much zinc buildup on the edges of the steel. The rods that trimmed the

steel were not properly aligned. U.S. Steel also discovered that Ford was wasting steel and money by scraping the bottom sheet of each pile of steel. Ford mistook the harmless white residue on the bottom sheets for rust, when in fact the residue was caused by tremendous pressure from the heavy pile and could easily be wiped off.

The organization should also continually keep informed about new developments in the customer's industry by reading their journals and attending their conferences. Brain-storming sessions with the customers about future products and services should be held at least annually.

Report Card

Another very effective information-gathering tool is the report card. Figure shows a typical one. It is usually sent to each customer on a quarterly basis.

QUARTERLY REPORT CARD

To our Customers:

We are continually striving to improve. To assist us in this endeavor, we need your feedback. Would you please grade our performance in each category? The grading scale is

A	=	Excellent
B	=	Very Good
C	=	Average
D	=	Poor
E	=	Failing

I. PRODUCT QUALITY Grade _____

Comments: _____

II. ON-TIME DELIVERY Grade _____

Comments: _____

III. SERVICE Grade _____

Comments: _____

IV. OVERALL Grade _____

Comments: _____

Signed _____ Date _____

Title _____Organization _____

The Internet and Computers

Some managers are beginning to monitor discussions that take place on the Internet to find out what customers are saying about their products. Internet users frequently seek advice regarding their everyday activities or activities related to specific interests, hobbies, or sports. Newsgroups, electronic bulletin boards, and mailing lists can be scanned using keyword searches if one knows that a company's product is of interest to participants in certain activities, hobbies, or professions. Ideally, messages that compare a company's products with those of its competitors can be uncovered. In the newsgroups it is best to read the views and discussions of others and not intervene in the discussion with the organization's perspective on the product or service. Intervening will most likely end the discussion. Monitoring Internet conversations is timely, the cost is minimal, and it can be a source of creative ideas. One of the drawbacks of monitoring Internet conversations, however, is that the conversations can be unfocused.

There are even Internet sites that take consumer complaints and compliments about businesses and gives organizations grades based on their ratio of complaints to compliments. Planetfeedback.com also sends letters to companies on behalf of consumers. The organization's web page also provides an easy way for customers to e-mail the company with their thoughts on the organization's products and services.

Computers can be used to detect patterns in seemingly chaotic data. For instance, the sales data from a convenience store chain showed that the peak hours for selling diapers and for selling beer were the same. The diapers were put next to the beer and sales increased for both. [18]

Employee Feedback

Employees are often an untapped source of information. Companies are listening more to the external customer but still are not listening to employees. Employees can offer insight into conditions that inhibit service quality in the organization. Employee groups can brainstorm ideas to come up with solutions to problems that customers have identified.

Although customer research reveals what is happening, employee research reveals why it is happening. Employee feedback should be proactively solicited, instead of checking the wooden suggestion box once a year. For instance, Chrysler regularly surveys employees for issues, because employee surveys are timely compared to customer surveys. When staff members cannot get what they need or have low morale, then they cannot provide good service. Chrysler requires that management share the survey results with employees and uses the findings to make substantial changes.

CUSTOMER RETENTION

a. ***Customer retention*** is the process of retaining the existing customers. It is obvious that customer retention is more powerful and effective than customer satisfaction.

b. ***Customer care*** can be defined as every activity which occurs within an organization that ensures that a customer is not only satisfied but also retained.

c. The following research findings will enable us to understand the real significance of customer retention. The important research findings are:

a. Over 60% of an organization's future revenue will come from existing customers.
b. A 2% increase in customer retention has an equivalent impact upon profitability as a 10% reduction in operating costs.
c. Upto 96% of unhappy customers do not infact complain. But they are three times more likely to communicate a bad experience to other custome5rs than a good one.
d. 91% of the unhappy customers will never purchase goods and services from you again.
e. If you make an effort to remedy customers' complaints, 82 to 95% of them will stay on with you.
f. It costs 5 times as much to attract a new customer as it costs to keep an old one.

Thus the customer retention is more essential than attracting new customers.

a. Customer retention represents the activities that produce the necessary customer satisfaction that creates customer loyalty.
b. Customer retention can be improved by obtaining customer feedback and by measuring customer satisfaction.
c. Customer feedback is obtained from customer satisfaction surveys, focus groups, interviews, and observations. Customer satisfaction should be measured by using the hard measures of cash register receipts, market share, the level of customer retention, and the number of referrals from customers.
d. Customer retention really moves the customer satisfaction to the next level called customer delight.

EMPLOYEE MOTIVATION

CONCEPT OF MOTIVATION

a. Scott defines, "Motivation means a process of stimulating people to accomplish desired goals."
b. Edwin B. Flippo defines, "Motivation is the process of attempting to influence others to do your will through the possibility of reward."
c. In simple words, motivation is the process of inducing people inner drives and action towards certain goals and committing his energies to achieve these goals.

IMPORTANCE OF MOTIVATION

a. Motivation improves employee involvement.
b. Motivation promotes job satisfaction and thus reduces absenteeism and turnover.
c. Motivation helps in securing a high level of performance and hence enhances efficiency and productivity.
d. Motivation creates a congenial working atmosphere in the organization and thus promotes interpersonal cooperation.

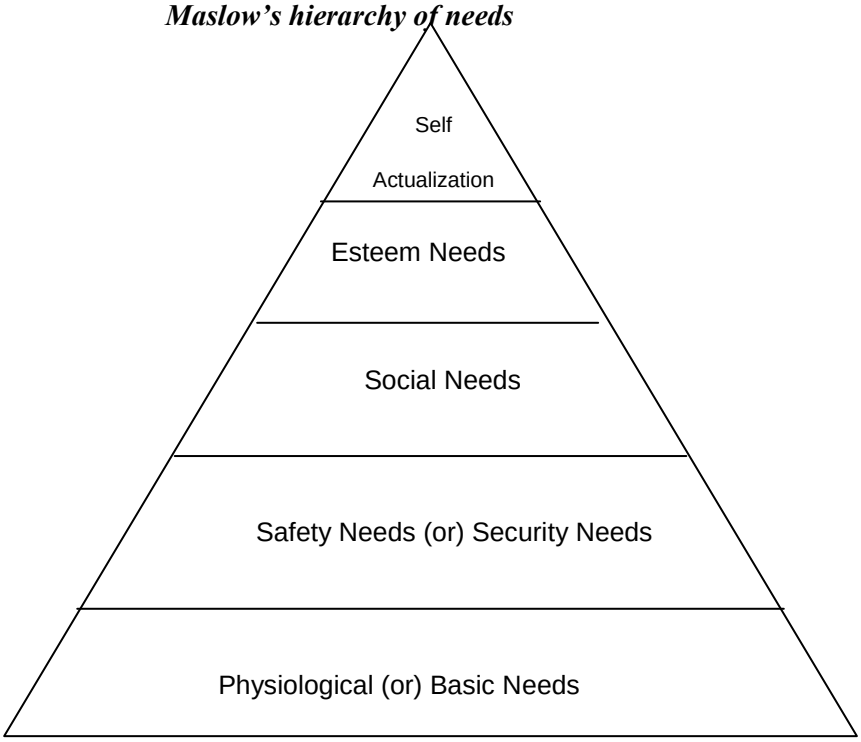
THEORIES OF MOTIVATION

Though there are many theories of motivation, the Maslow's hierarchy of needs theory and Herzberg's two factor theory are more important from our subject of view.

Maslow's Hierarchy of Needs

According to Maslow human motivation is a hierarchy of five needs, as shown in Figure. The five basic needs are : (1) Physiological; (ii) Safety; (iii) Social; (iv) Esteem; and (iv) Self-actualization. These needs form a hierarchy or ladder and each need becomes active only when the next lower need is reasonably satisfied.

Maslow's hierarchy of needs



1. Physiological or Survival Needs

Physiological needs are the biological needs required to preserve human life. These needs include needs for food, clothing and shelter. These needs must be met first before higher level needs emerge.

2. Safety Needs

When the physiological needs are reasonably satisfied, then the safety needs become activated. These needs include : (i) Protection from physiological dangers (fire, accident); (ii) Economic security (fringe benefits, health, insurance); (iii) Desire for an orderly and predictable environment; and (iv) Desire to know the limits of acceptable behaviour. These safety needs are really provisions against deprivation in the future. It also involves a sense of protection against danger and threats.

3. Social Needs

After the needs of the body and security are satisfied then a sense of belonging and acceptance becomes predominant in motivating behaviour. These needs are for love, friendship, exchange of feelings and grievances, recognition, conversation, belongingness, companionship, etc.

4. Esteem Needs

There are two types of esteem needs : Self-esteem and esteem of others. Self-esteem needs include those for self-confidence, achievement , competence, self-respect, knowledge and for

independence and freedom. The second group of esteem needs are those that related to one's reputation needs for status, for recognition, for appreciation and the deserved respect of one's fellows.

5. Self-Actualization Needs

This is the ultimate need which dominates a person's behaviour when all lower needs are satisfied. Self-actualisation, also called self-realisation needs, refers to the desire to become everything that one is capable of becoming.

The first three needs, also known as lower level needs, can be satisfied by monetary and non-monetary compensations. But the last two needs, also known as higher level needs, can be satisfied through participation in decision-making process, delegation of authority and responsibility, more freedom, self-development, etc.

Herzberg's Two Factor Theory

This theory is also called ***motivation-hygiene theory***. This theory is based on two factors: 1. Motivation factors or satisfiers, and 2. Hygiene factors or dissatisfiers. Various motivation and hygiene factors are listed in Table.

Motivation and hygiene factors

Motivation Factors	Hygiene Factors
• **Achievement**	• Supervisors
• **Recognition**	• Working conditions
• **The work itself**	• Interpersonal relationships
• **Responsibility**	• Pay and security
• **Advancement and growth**	• Company policy and administration

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

On the other hand, motivational factors creates satisfaction to the workers at the time of presence but their absence does not cause dissatisfaction. It can be noted that Herzberg's dissatisfiers are roughly equivalent to Maslow's lower levels, and the motivators are similar to the Maslow's upper levels.

Thus the knowledge of motivation is required for any organization to understand the utilization of employee involvement.

EMPLOYEE EMPOWERMENT

CONCEPT OF EMPOWERMENT

Empowerment is the opposite of helplessness or dependency. An empowered person does not feel incapable of doing the things that he considers important for the well-being of his organization. There are no constraints that he perceives to be externally imposed. In other words, being empowered

implies that the person acts from a state of autonomy, doing what he knows is the right thing to do under a given set of circumstances.

It is understood that empowerment is dependent upon two factors:

(i) An individual's personal choices; and

(ii) The organization climate, that can either encourage dependency or foster autonomy.

EMPOWERMENT DEFINED

1. According to Webster's Dictionary, the verb ***empower*** means 'to give the means, ability or authority'. Therefore empowerment in work setting involves giving people the means, ability and authority to do something they have not done before.

2. ***An operation definition of empowerment:*** "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.

Job Enrichment Vs Job Empowerment

Job enrichment is aimed at expanding the content of an individual's job. But job empowerment focuses on expanding on the context of the job such as its interactions and interdependencies to other functions of the organization.

GENERAL PRINCIPLES FOR EMPOWERING EMPLOYEES

The following general principles may be used to empower the employees.

- Tell people what their responsibilities are.
- Give them authority equal to the responsibility assigned to them.
- Set standards of excellence.
- Provide them with training that will enable them to maintain standards.
- Give them knowledge and information.
- Provide them with feedback on their performance.
- Trust them and create trust worthiness in the organization.
- Allow them to fail but guide them and counsel them when needed.
- Treat them with dignity and respect.

CONDITIONS TO CREATE THE EMPOWERED ENVIRONMENT.

The three conditions required to create the empowered environment are:

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

CHARACTERISTICS OF EMPOWERED EMPLOYEES

Some important characteristics of empowered employees, identified by Hubert Rampersad, are that:

- They feel responsible for their own task.

- They are given a free hand in their work.
- They balance their own goals with those of the organization.
- They are well trained, equipped, creative, and customer oriented.
- They are critical, have self-esteem, and are motivated.
- They are challenged and encouraged.
- They monitor and improve their work continuously.
- They find new goals and change challenges.

Therefore, it is important to empower individuals and teams at all levels of the organization to achieve the continuous improvement process.

RECOGNITION AND REWARD.

MEANING:

Recognition is a process whereby management shows acknowledgement of an employee's outstanding performance. Recognition is a form of employee positive motivation. Recognition of employees is highly essential as people find themselves in a accepted and winning role. To sustain employee's interest and to propel them towards continuous improvement, it is essential to recognize the people. This acknowledgement may be of financial, psychological or both in nature.

Ways to recognize people

Send letters to improve team members when they establish a team thanking them for their involvement.

1. Develop a behind the scenes awards specifically for those whose actions are not usually in the lime light, make sure such awards are in the lime light.
2. Create best ideas of the year booklet and include everyone's picture name and description of their best ideas.
3. Feature the quality team of the month and put their picture in a prominent place.
4. Honor peers who have helped you by recognizing them at your staff meetings.
5. Let people attend meetings, committees etc; in your place when you are not available.
6. Involve teams with external customers and suppliers, sending them on appropriate visits to solve problems and look for opportunities.
7. Invite a team for coffee or lunch at any time, not necessarily when you need them for something.
8. Create a visibility wall to display information, posters, and pictures, thanking individual employees and their teams**,** and describing their contributions.
9. When you are discussing an individual or group ideas with other people, peers, or higher management make sure that you give them credit.

WHY SHOULD ONE RECOGNISE PEOPLE

1. improve employees morale
2. show the company's appreciation for better performance
3. create satisfied workplace
4. Create highly motivated workplace.
5. Reinforce behavioral patterns.
6. Stimulate creative efforts.

REWARD

MEANING:

Reward is a tangible one, such as increased salaries, commissions, cash bonus, gain sharing, etc; to promote desirable behavior.

TYPES OF REWARDS:

1. Intrinsic rewards
2. Extrinsic rewards

Intrinsic rewards are related to feelings of accomplishment of self-worth.Extrinsic reward are related to pay or compensation issues.

INTRINSIC REWARDS

1. Non-monetary forms of recognition to acknowledge achievement of quality improvement goals.

2. Celebration to acknowledge achievement of quality improvement goals.

3. Regular expressions of appreciation by managers and leaders to employees to acknowledge achievement of quality improvement goals.

4. 360 degree performance appraisals feedback from co-workers subordinates to customers is incorporated into performance appraisals.

EXTRINSIC REWARDS:

1. Profit sharing
2. gain sharing
3. employment security
4. compensation time
5. individual based performance systems
6. quality based performance appraisals

TEAMS AND TEAM WORK

WHAT IS MEANT BY A TEAM AND TEAM WORK?

- ***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 interests and opinions to fulfill the objectives or goals of the group.
- ***TQM*** is based on the involvement of everyone in making improvements. So working in teams is an inseparable part of the TQM environment. Nowadays teamwork is adopted universally as the organizational mechanism for involving people in quality improvements.

BENEFITS OF TEAM WORK

The benefits of teamwork include:

1. Improved solutions to quality problems.
2. Improved ownership of solutions.
3. Improved communications.

4. Improved integration.

TYPES OF TEAMS

Teams can be classified into four major groups. They are:

1. Process improvement team,
2. Cross-functional team,
3. Natural work team, and
4. Self-directed / self-managed work team.

It can be seen from the figure that by the direction of quality council, several cross functional teams can be established. These teams address specific improvement problems of several functional areas. Within the functional areas, one or more process improvement teams may be established. In turn, one or each functional areas may establish a workgroup to address overall improvements to the particular area.

The use of teams throughout an organization

CHARACTERISTICS OF SUCCESSFUL TEAMS

The effective team should have certain characteristics. These are :

1. Sponsor : In order to have effective liason with the quality council, there should be a 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 : The size of the team should not exceed ten members except in the case of natural work teams or self-directed teams. Teams should be diversed by having members with different skills, perspective and potential. Wherever needed, the internal and external customers and suppliers should be included as a team member.

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 is not to be effective.

7. Accountability: The team performance is accountable. Periodic status report of the team should be given to the quality council. The team should review its performance to determine possible team process weaknesses and make improvements.

8. Well-defined Decision Procedures: The decision should be made clearly at the right time by the team.

9. Resources: The adequate information should be given to the team wherever needed. The team cannot be expected to perform successfully without the necessary tools.

10. Trust : Management must trust the team to perform the task effectively. There must also be trust among the members and a belief in each other.

11. Effective Problem-Solving : Problem-solving methods are used to make the effective decision.

12. Open Communication : Open communication should be encouraged i.e., everyone feels free to speak in the team whatever they are thinking, without any interruptions.

13. Appropriate Leadership: Leadership is important in all the team. Leader is a person who leads the team, motivates the team and guides the team in a proper direction.

14. Balanced Participation : Everyone in a team should be involved in the team's activities by voicing their opinions, lending their knowledge and encouraging other members to take part.

15. Cohesiveness: Members should be comfortable working with each other and act as a single unit, not as individuals or subgroups.

ELEMENTS OF EFFECTIVE TEAM WORK

Main elements of effective teamwork are as follows:

1. Purpose
2. Role and responsibilities
3. Activities
4. Effectiveness
5. Decisions
6. Results, and
7. Recognition.

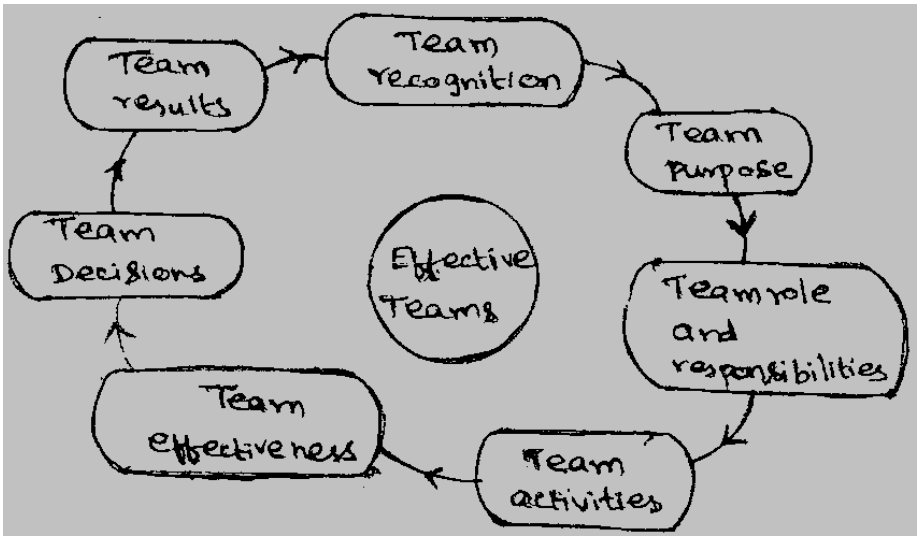


Figure depicts the seven main elements of effective teamwork

BARRIERS TO TEAM PROGRESS

The various roadblocks to team progress are :

1. Insufficient training
2. Incompatible rewards and compensation.
3. First-line supervisor resistance
4. Lack of planning.
5. Lack of management support
6. Access to information systems
7. Lack of union support.
8. Project scope too large.
9. Project objectives are not significant.
10. No clear measures of success.
11. No time to do improvement work.

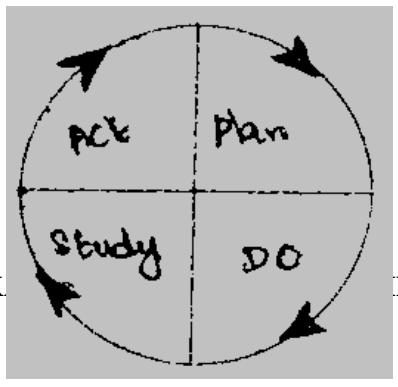
ROLE OF TEAM MEMBERS

For effective teamwork, team members are required to perform a number of roles and responsibilities. Thus all team members should :

i) Devote themselves to the common team goals based on a common mission and vision.
ii) Feel themselves responsible and equal.
iii) Be interested and motivated.
iv) Accept, appreciate, and respect each other.
v) Give high priority to continuous improvement.
vi) Participate actively with the activities of the team.
vii) Offer views, opinions and ideas freely and voluntarily.

PDSA CYCLE (OR DEMING WHEEL)

The basic Plan – Do – Study – Act cycle was originally developed by Walter A. Shewart. But it was popularized by Edward Deming and that's why it is often called the ***Deming Cycle*** or ***Deming Wheel.*** It is an effective continuous improvement technique.



What is PDSA Cycle?

- PDSA stands for Plan, Do, Study, and Act. It is a model for testing ideas that you think may create improvement.
- It is an extremely practical, common sense based approach that is easy to understand.
- 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.
- Illustrates the PDSA cycle.

Phases of PDSA Cycle

The four phases of PDSA cycle and their descriptions are presented in Table.

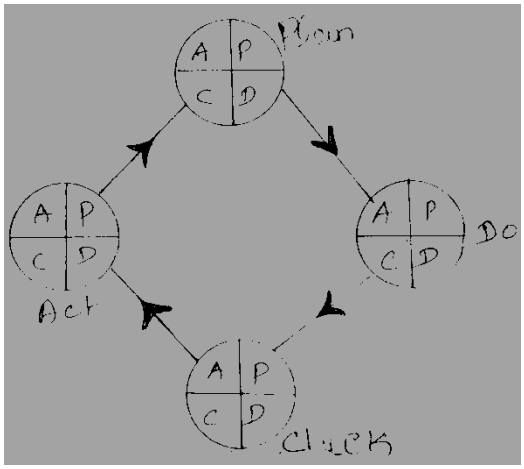
Phases of PDSA Cycle

Phases	Description
1. Plan	• Define the problem • Analyze the causes and draft an action plan for solving the problem. • Determine the quality objectives and the critical factors. • Define the performance indicators. • Collect and analyze the necessary process data. • Generate possible solutions • Select the most feasible solution; and work it out.
2. Do	• First, implement the plan on a limited scale or conduct an experiment to test the proposed improvement. Collection data is hereby essential. • Train all involved employees in the use of quality improvement methods and techniques. • Describe the process which is considered for improvement and form project teams to lead the process.
3. Check	• Evaluate the trial project with the performance indicators. • Verify whether the improvement has been successful or not.
4. Act	• Act to implement proven improvements. The choices are: introduce the plan, adjust or reject it. • The improvements are documented in standard procedures so all employees are well-informed on how to handle in future. • Usually, the cycle will be repeated under the different circumstances and conditions to test how consistent the results are.

Continuous Process Improvement Cycle Using PDCA

The relationship between the PDSA cycle and eleven steps to continuous process improvement are illustrated in figure.

Each phase of the PDCA cycle must undergo its own PDCA cycle for further improvements, as shown in figure.



Applying PDCA to its phases

Benefits of the PDSA Cycle

The benefits of the PDSA cycle can be experienced in the following areas:

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

5S

5S Philosophy focuses on effective work place organization and standardized work procedures. 5S simplifies your work environment, reduces waste and non-value activity while improving quality efficiency and safety.

Sort – (Seiri) the first S focuses on eliminating unnecessary items from the workplace.

Set In Order (Seiton) is the second of the 5Ss and focuses on efficient and effective storage methods.

Shine: (Seiso) Once you have eliminated the clutter and junk that has been clogging your work areas and identified and located the necessary items, the next step is to thoroughly clean the work area.

Standardize: (Seiketsu) Once the first three 5S‟s have been implemented, you should concentrate on standardizing best practice in your work area.

Sustain: (Shitsuke) This is by far the most difficult S to implement and achieve.

Once fully implemented, the 5S process can increase morale, create positive impressions on customers, and increase efficiency and organization.

Kaizen

Kaizen is a Japanese word for the philosophy that defines management's role in continuously encouraging and implementing small improvements involving everyone. It is the process of continuous improvement in small increments that make the process more efficient, effective, under control and adaptable.

The Kaizen improvement focuses on the use of :

- Value – added and non – value work activities.
- Muda, which refers to the seven classes of waste – over-production, delay, transportation, processing, inventory, wasted motion, and defective parts.
- Principles of motion study and the use of cell technology.
- Principles of materials handling and use of one – piece flow.
- Documentation of standard operating procedures.
- The five S's for workplace organization.
- Visual management.
- Just – in – time principles.
- Poka – Yoke.
- Team dynamics.

SUPPLIER PARTNERING

What is Supplier Partnering?

Partnering is a 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 the risks and rewards of the relationship. The relationship between customer and supplier should be based upon trust, dedication to common goals and objectives, and an understanding of each party's expectations and values.

Benefits of Partnering

The benefits of partnering include:

(i) improved quality;

(ii) reduced cost;

(iii) increased productivity;

(iv) increased efficiency;

(v) increased market share;

(vi) increased opportunity for innovation; and

(vii) continuous improvement of products / services.

Key Elements to Partnering

The three important elements to achieve the customer / supplier partnering relationship are :

1. Long-term commitment: Long-term commitment provides both customer and supplier the much needed environment to achieve the planned objectives. Because to set up and solve the problem of continuous improvement, both parties may require the sufficient time.

2. Trust : Mutual trust between two parties forms the basis for a strong working relationship. Trust enables the partners to effectively combine their resources and knowledge. It results in a 'win-win' situation for both partners.

3. Shared vision : Both the customers and suppliers have the common goal i.e., to satisfy the end user. In order to ensure this goal, both particles should share and understand their goals and objectives.

Three types of supplier sourcing are:

- Sole sourcing;
- Multiple sourcing, and
- Single sourcing.

1. Sole Sourcing

Sole sourcing is the use of only one supplier for the organization. The organization does not have any choice. It is forced to use only one supplier.

This forced situation is because of the following factors : patents, technical specifications, raw material location, only one organization producing the item, etc.

2. Multiple Sourcing

Multiple sourcing is the use of two or more suppliers for an item.

The basic concept of multiple sourcing is that competition will result in better quality, lower costs, and better service. (The selection of suppliers from various alternatives is based on their performance in terms of prices, quality and delivery.

3. Single Sourcing

Single sourcing is the use of one supplier for an item when several sources are available. It leads to long-term partnering relationship.

SUPPLIER SELECTION

Usually suppliers are selected based on their performance in terms of cost, quality, and delivery reliability. In addition, supplier criteria includes factors such as management compatibility, goal congruence, and strategic direction of the supplier firm.

Table Ishikawa's ten conditions for selection and evaluation of suppliers

1. The supplier should understand and appreciate the management philosophy of the organization.

2. The supplier should have a stable management system.

3. The supplier should maintain high technical standards and have the capability of dealing with future technological innovations.

4. The supplier should provide those raw materials and parts required by the purchaser and those supplied meet the quality specifications.

5. The supplier should have the capability to produce the amount of production needed.

6. The supplier should not breach the corporate secrets.

7. The supplier should be easily accessible in terms of transportation and communication.

8. The supplier should be sincere in implementing the contract provisions.

9. The supplier should have an effective quality system and improvement program such as ISO/QS 9000.

10. The supplier should have a tract record of customer satisfaction and organization credibility.

SUPPLIER RATING

A supplier rating system, also referred as a scorecard system, is used to obtain an overall rating of supplier performance. It is analogous to students progress report.

Usually supplier rating is based on quality, price, performance and production capability, delivery, service.

Objective of Supplier Rating

The customer rates supplier in order to:

- obtain an overall rating of supplier performance ;
- ensure complete communication with suppliers;
- provide each supplier about the details of problems for corrective action; and
- maintain and improve the partnering relationship between the customer and the supplier.

PERFORMANCE MEASURES

Performance measures are required for the managers for managing an organization perfectly. Performance measures are used to achieve the following objectives.

- To establish performance measures and reveal trend.
- To identify the processes to be improved.
- To determine the process gains and losses.
- To compare the actual performance with standard performance.
- To provide information for individual and team evaluation.
- To determine overall performance of the organization.
- To provide information for making proper decisions.

WHAT SHOULD BE MEASURED?

Human resources

1. Lost time due to accidents, absenteeism.
2. Employee turnover.
3. Employee satisfaction index.
4. Training cost per employee.
5. Number of grievances.

Customers

1. Number of complaints from customers.
2. Number of on-time deliveries.
3. Warranty data.
4. Dealer satisfaction.

Production

2. Inventory.
3. SPC Charts.
4. Amount of scrap / rework.
5. Machine down time.

Research and Development

2. New product time to market.
3. Design change orders.
4. Cost estimating errors.

Suppliers

2. On-time delivery.
3. Service rating.
4. Quality performance.
5. Average lead time.

Marketing / Sales

2. Sales expense to revenue.
3. New product sales to total sales.
4. New customers.

Administration

1. Revenue per employee.
2. Purchase order error.
3. Billing accuracy.
4. Cost of poor quality.

STRATEGY

The quality council has the overall responsibility for the performance measures. It ensures that all the measures are integrated into a total system of measures.

A typical system contains the following function

- Quality
- Cost
- Flexibility
- Reliability
- Innovation

PERFORMANCE MEASURE PRESENTATION :

There are six basic techniques for presenting performance measures. They are

1. Time series graph.
2. Control charts.
3. Capability Index.
4. Taguchi's loss function.
5. Cost of poor quality.
6. Malcolm Baldrige National Quality Award.

In MBNQA, five categories are analyzed. They are

a) Manufacturing
b) Service
c) Small business
d) Health care
e) Education

UNIT – III

STATISTICAL PROCESS CONTROL

SEVEN TOOLS OF QUALITY (Q-7 TOOLS)

Prof. Ishikawa proposed seven elemental tools based on statistical techniques.

The seven basic tools are used to facilitate successful accomplishment of quality improvement objectives.

Seven tools of quality are:

1. Check sheets,
2. Histograms,
3. Cause and effect diagrams,
4. Pare to diagrams,
5. Stratification analysis,
6. Scatter diagrams, and
7. Control charts.

Check sheet:

A check sheet also known as tally sheet is a form for systematic data gathering to get a clear view of the facts.

CHECK SHEET

Product : Bicycle

Nonconformity Type	Check	Total
Blister	𝍸 𝍸 𝍸 𝍸 I	21
Light spray	𝍸 𝍸 𝍸	15
Drips	𝍸 𝍸 𝍸 𝍸 𝍸	25
Others	𝍸 𝍸 𝍸 𝍸 𝍸	25
	TOTAL	86

Histograms:

A histogram is a bar chart showing a distribution of variable quantities or characteristics.

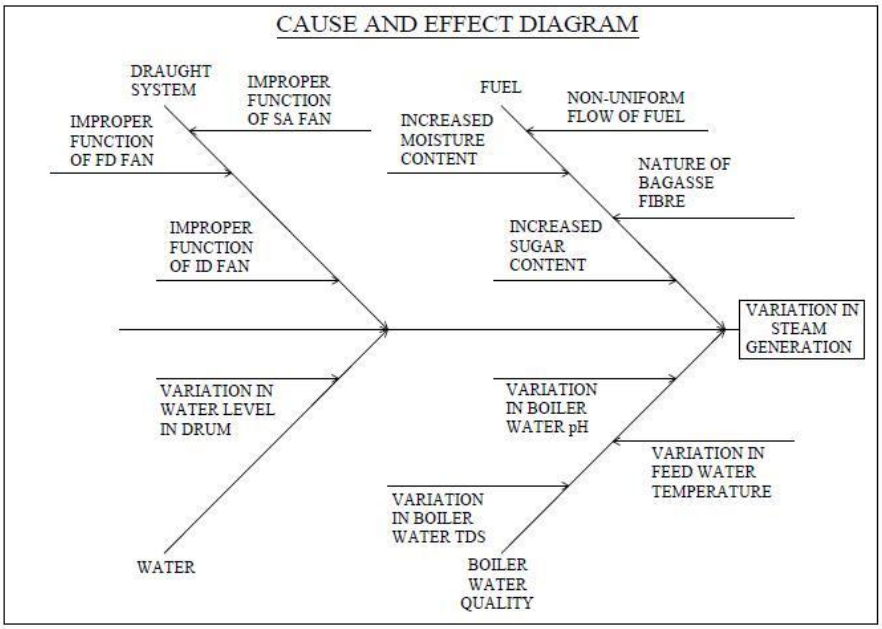
5. **HISTOGRAM**

NUMBER OF ERRORS TALLY OF NUMBER OF ERRORS

0	1	3	0	1	0	1	0	Number Non	Tabulation	Freq.		
1	5	4	1	2	1	2	0	-conforming				
1	0	2	0	0	2	0	1					
2	1	1	1	2	1	1		0	~~IIII~~ ~~IIII~~ ~~IIII~~	15		
0	4	1	3	1	1	1		1	~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~	20		
1	3	4	0	0	0	0		2	~~IIII~~ III	8		
1	3	0	1	2	2	3		3	~~IIII~~	5		
								4	III	3		
								5	I	1		

Cause and effect diagram:

The cause and effect diagram is a graphical tabular chart to list and analyze the potential causes of a given problem. The cause 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.



STEPS IN CONSTRUCTING A CAUSE & EFFECT DIAGRAM :

- Define the problem or effect to be analyzed.
- Form the team to perform the analysis. Often the team will uncover potential causes through brainstorming.
- Draw the effect box and the centerline.

- Specify the major potential cause categories and join them as boxes connected to the centerline.
- Identify the possible causes and classify them into the categories in step d. Create new categories, if necessary.
- Rank order the causes to identify those that seem most likely to impact the problem.
- Take corrective action

Pareto diagram:

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

Stratification analysis:

Stratification is a method of analysis of data by grouping it in different ways. Literally stratification means segregating a group of measurements, observations or any other data in to several subgroups on the basis of certain characteristics.

Scatter diagram:

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 measure values of one variable and a vertical axis, representing the measurements of the variable.

In scatter diagram, three types of co-relations exist.

1. Positive correlation.
2. Negative correlation.
3. No correlation.

Control chart:

A control chart is a graph that displays data taken over time and the variations of this data. The control chart is based on a series of random samples taken at regular intervals.

MANAGEMENT TOOLS

Why?

It is a simple and effective tool. This approach focuses on the process (to reveal the causes), rather than the people.

Example: Why was there a delay in dispatch of good?

Cutting tool failed, resulting in delay in manufacture.

Why? The tools were reused?

Why? Ordered tool were not delivered?

Solution changes the dispatch schedule, if ever the tools were not delivered.

Forced Field Analysis

Readers' attention is invited to the discussion in Chapter 2 on this topic.

Nominal Group Technique

This technique provides for ideas input from every one in the team and for effective decision making.

A team wants to decide upon a current complaint to attend. Every one in the team writes the problem on a paper, what they think is most important. They are listed in a chart and then the team members are asked to rank, from most important to least important. The ranking are given a numerical value starting from, say, on a 10 to 1 scale. Points for each problem is totaled and the ones with highest number of points, is considered o be the most important.

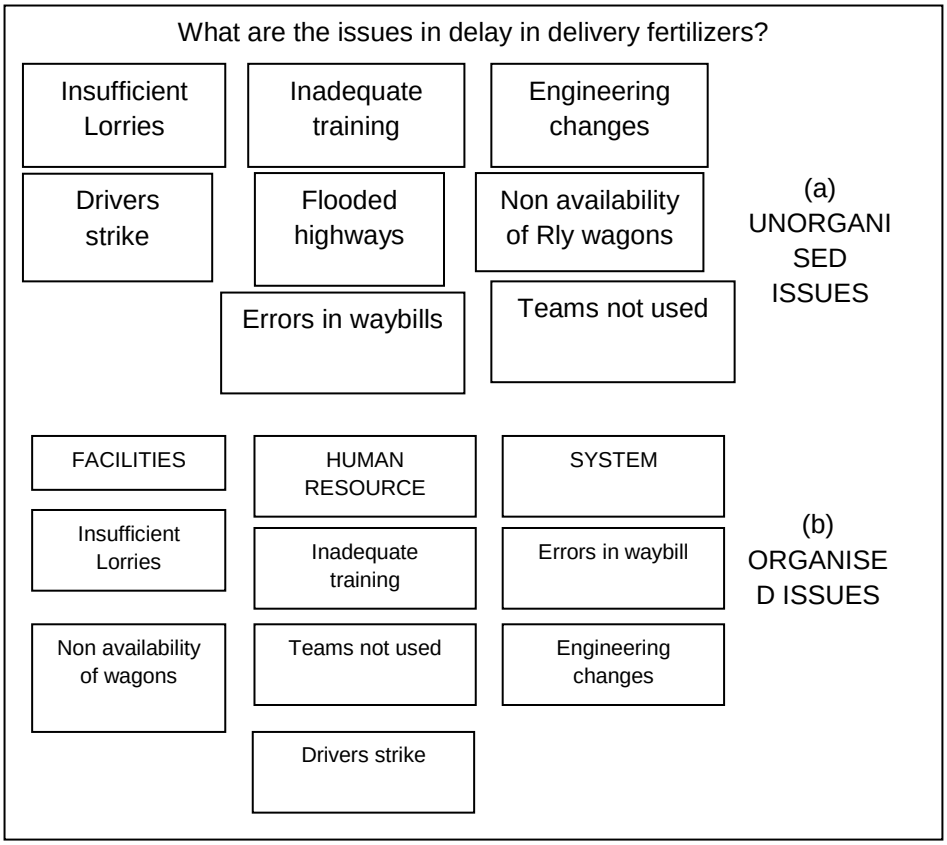
MANAGEMENT AND PLANNING TOOLS

Affinity Diagram

This diagram permits the team to creatively generate large number of ideas and then group them logically for understanding and possible solutions.

In this procedure, the issue is stated in full, then brainstormed using short sentences, posted them for the team to see. The ideas are sorted into logical groups and finally brief headings for each group are identified. The affinity diagram encourages team creativity, break down barriers, promote breakthroughs and motivate ownership of the process. Figure shows a typical example of this approach.

Affinity diagram



Inter-Relationship Diagram

This method is useful in clarifying the relationship in complex situations. The team will be able to classify the cause and effect relationship, so that the key elements can be used to solve the problems.

Steps:

The team agrees on the statement of the problem.

Different ideas or issues from other methods are initially listed and named with alphabets, A B etc.

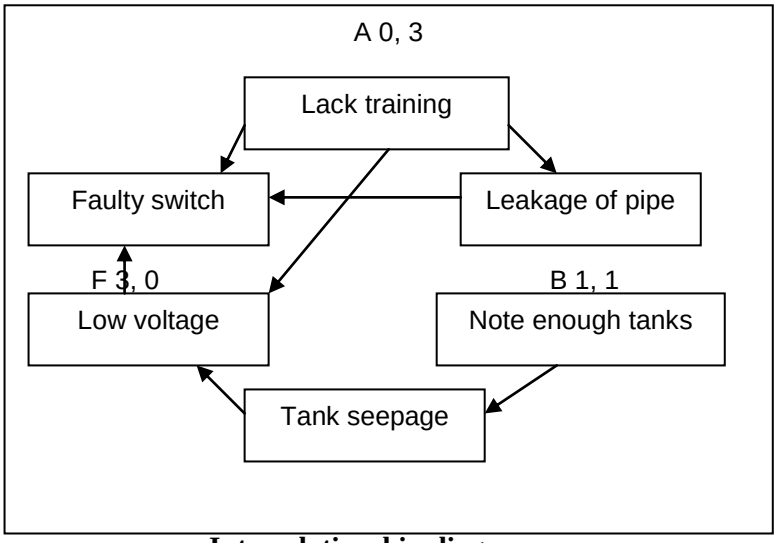
Begin with the issue A, and evaluate the cause and effect relationship with B. If A is stronger, draw the arrow A to B, by a thick line. Each issue is compared with A, one by one. Draw thick arrows wherever strong influence is identified. In this example, only issues B, E and F have relationship with A. The first trial is now over.

Second iteration is to compare B with issues C, D, E and F. The third step is to compare C with other issues. The fourth is compare issue D with E and F. The fifth step is to compare issue E with F.

The diagram may be reviewed and revised, if necessary.

The incoming and outgoing arrows are recorded as indicated, above the rectangle block. The completed diagram is shown in figure.

The issue with highest outgoing arrows (A), is the root cause and the issue with highest incoming arrows (F), is the critical issue. This method encourages the team work and effectiveness in identifying major problem and the root cause, to tackles further the problem.



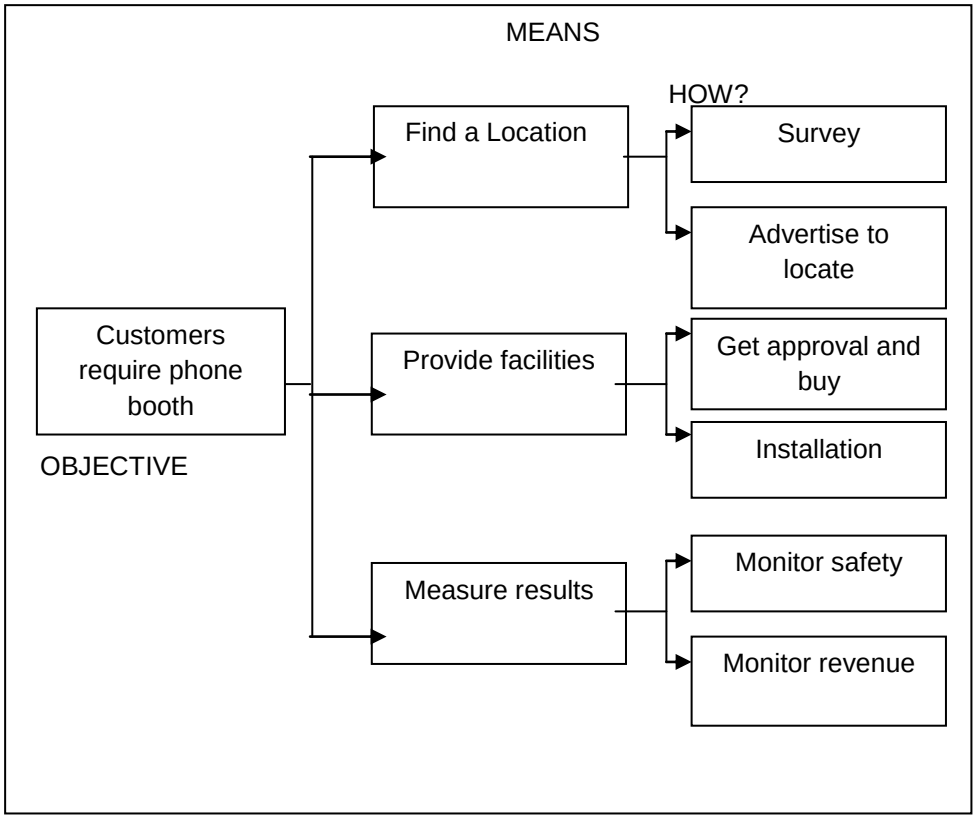
Interrelationship diagram

Tree Diagram

In the first step, the objective is traced from the interrelationship diagram, brainstorming and team participation. Using further brainstorming, major means are identified.

In the next step, the next level details are generated for study and solution. The question, "What is need next?" is repeated to two three levels, to complete the diagram. The diagram may be

reviewed to find, if any actions are ignored or the action will yield expected results. An example of this approach is shown in figure. The merit of this method is that it encourages the team work and thoroughness.



Tree diagram

Matrix Diagram

The Matrix diagram helps to identify, analyse and rate the relationship among the variables. Data can be presented in tabular form, with numerical values or otherwise. Quality function Deployment, is a typical example of the matrix diagram. The standard formats that are used are: for 2 variables, L shaped; for 3 variables, T shaped, Y shaped and C shaped and for 4 variables, X shaped. L shaped matrix diagram for 2 variables are most frequently used. Matrix diagram for uses of seven management tools**;**

Tool	Use creativity	Analysis	Consen-sus	Action
Affinity diagram	⊙		O	Δ
Interrelationship diagram				
Tree diagram		O	⊙	
Prioritisation matrix		⊙		⊙
Matrix diagram			O	

Process decision		O	⊙	O
Program chart				
Activity network	⊙	⊙	⊙	O
Diagram				
			⊙	O

The seven management tools are presented in Table as matrix diagram. The steps involved in its construction are: select the appropriate format

Determine the relationship symbols. Numerical values may be added when necessary

Complete the matrix, by analyzing each cell and insert appropriate symbol.

The matrix diagram approach encourages lateral thinking by the team, in terms of the relationships, their strengths and patterns.

Prioritization Matrix

In this method the issues, tasks, and characteristics are prioritized, based on weighted criteria, using a combination of tree and matrix diagram techniques. This is the most difficult, of the tools discussed.

Steps:

Construct an L shaped matrix combining the options, which are then lowest level of detail of the tree diagram with the criteria.

Determine the implementation criteria, using the nominal group technique or any other technique, with proper weight age criteria. Each team member submits the most important criteria on a piece of paper. They are listed on as flip chart and the team members submit the rank in another paper, ordering those listed criteria on the chart. Those criteria with greatest value are the most important. Three or four criteria are chosen.

Prioritize the criteria using the NGT. Each team member weighs the criteria so the total weight equals 100%. The results are shown in Table.

Table: Weightage for different criteria

Criteria	Member A	Member J	Member M	Total
Low cost	30	25	35	155
Easy to implement	40	30	30	210
Technology permits	15	20	25	100

Customer preference	20	25	20	110

Using NDT, the options are ranked, in terms of importance by each criterion; the results are averaged, and rounded to the nearest integer.

Compute the option importance score under each criterion, by multiplying the rank by the weight age of criteria. The details are shown in Table. The options with the highest total are those that should be implemented first.

Table: Improvement of a process by consensus criteria method

CRITERIA

Options	Low cost		Easy to implement		Technology permits		Customer preference	Total
1. Train supervisor	10x1.55	+	12x2.10	+	8x1.0	+	9x1.1	58.6
2. Purchase trucks	12x1.55	+	8x2.10	+	9x1.0	+	7x1.1	52.1
3. Have teams of 4 men	8x1.55	+	7x2.10	+	10x1.0	+	6x1.1	43.7
4. Training clerks	6x1.55	+	6x2.10	+	8x1.0	+	5x1.1	35.4

Process Decision Program chart

The Process decision program chart avoids unexpected developments and identifies possible counter measures. Figure shows an example of this technique.

Level 1 objective		**Plan Seminar**		
Activities	Call for paper	Registration	Conduct Proceedings	Boarding &

	& acceptance				Lodging
Level 2 What if?	Power Supply fails	Minister arrives Late	Printed proceedings arrived late		Too long Session
	|	|	|	|	|
Level 3 counter Measures	Have a stand by generator	Gave the collector to Inaugurate	Start the session	Send it by Post	Produce the present action

Initially the team states the objective that is to plan a successful industrial seminar. Those activities are listed in the first level, which are, call for papers, screening and acceptance, registration, and conduct proceedings and arranging Boarding and lodging facilities. The activity of conducting the proceedings is explained hereinafter. The team is brainstormed to determine what could go wrong with the seminar proceedings, and these are shown in Level 2 i.e., 'what if level'. Countermeasures are discussed and listed in the last level. Now the countermeasures are evaluated and the optimal ones are selected and marked O, and rejected ones are marked, X, as shown in the figure.

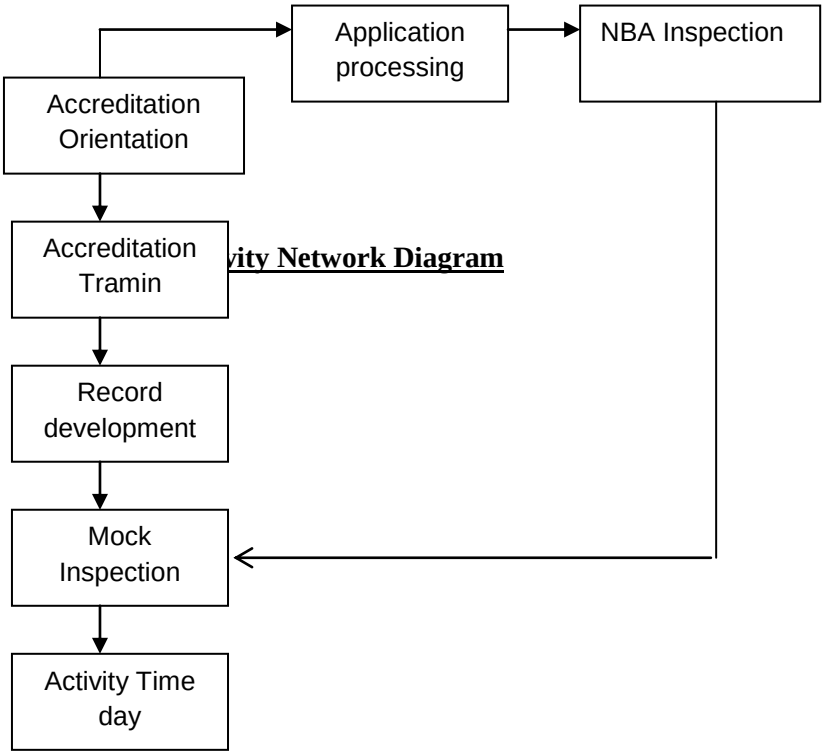
This method is preferred if the task is new or unique, complex, or potential failure has great risks. It provides a means to effectively minimize uncertainty in implementation stage.

Activity Network Diagram

PERT, CPM, and Arrow diagram are the typical variations of this diagram. They allow the team to schedule the project efficiently. The details such as the critical path, project completion time, simultaneous tasks, and precedence relationships are obtained from this diagram.

Steps:

- The team brainstorms or documents all the activities to complete the project.
- The first task is identified and fixed on the extreme left of the board.
- The tasks done simultaneously are placed in parallel.
- Steps (b) and (c) are repeated until all the tasks are located on the board in correct sequence, as shown in figure.
- Number all activities and draw the corresponding arrows. Activity times are recorded in the lower left box. It may be hours, days, weeks or months.
- Find the critical path, after completing the details of box in each activity.



ivity Network Diagram

The critical path is the path along which all the activities are completed in the minimum time. The advantages of this method are:

- **a.** A realistic project execution time is determined.
- **b.** Bottlenecks are identified and when necessary, corrective actions can be planned.
- **c.** Focus is made on the activities lying in the critical path. Time-cost trade off can be worked out, to complete the project earlier, with optimum additional cost.

STATISTICAL FUNDAMENTALS

Statistics is defined as the science that deals with the collection, tabulation, analysis, interpretation and presentation of quantitative data.

Data collected for quality control purposes are obtained by direct observation and are classified as

1. Variables (Measurable quality characteristics like length measured in metres)

2. Attributes (Quality characteristic which are classified as either **conforming** (or) **non-conforming** to specifications, such as "go & no-go" gauge.

MEASURES OF CENTRAL TENDENCY AND DISPERSION

There are two important analytical methods of describing a collection of data as

1. Measures of central tendency.
2. Measures of dispersion.

A measure of central tendency of a distribution is a numerical value that describes how the data tend to build up in the centre. There are three measures in quality as

1. Average
2. Median
3. Mode

Average is the sum of observations divided by the number of observations.

$$\text{Average} = \bar{X} = \frac{\sum_{i=1}^{i=n} X_i}{n}$$

where, n = number of observations

X_i = observed value

Median is the value which divides a series of ordered observations so that the number of items above it is equal to the number of items below it.

Mode is the value which occurs with the greatest frequency in a set of numbers. Mode can again classified as

- No mode
- Uni mode
- Bi mode
- Multimode

Measure of dispersion describes how the data are spread out on each side of the central value.
The two measures of dispersion are

1. Range
2. Standard Deviation

Range is the difference between the largest and smallest values of observations in a series of numbers.

Range = R

= X h – X l

Where, R =

Range

X h = highest observation in

a series X l = lowest

observation in a series

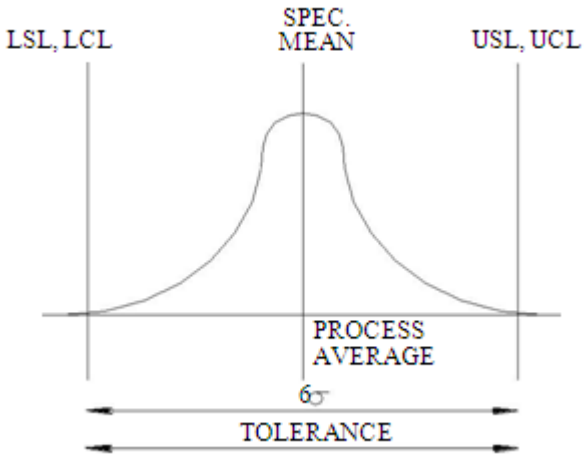
Standard Deviation measures the spreading tendency of the data. Larger the standard deviation, greater the variability of data.

$$S = \sqrt{\frac{\sum_{i=1}^{i=n} (X_i - \bar{X})^2}{n-1}}$$

where S = sample standard deviation
X_i = observed value
n = number of observations

NORMAL CURVE

Normal curve is common type of population. The normal curve is symmetrical, unimodal, bell – shaped distribution with the mean, median and mode all having the same value.



CONTROL CHARTS FOR VARIABLES AND ATTRIBUTES

Variation is a law of nature because no two natural items in any category are the same. Variations are due to the following reasons.

1. Chance causes or Natural causes.
2. Assignable causes.

Chance causes of variation are inevitable. Chance causes affect almost every production process and are inherent in the process. They are purely random, unidentifiable sources of variations.

Hence, when only chance causes are present in a process, the process is said to be in Statistical Control.

Assignable causes result in unnatural variations. The sources of variations may be due to

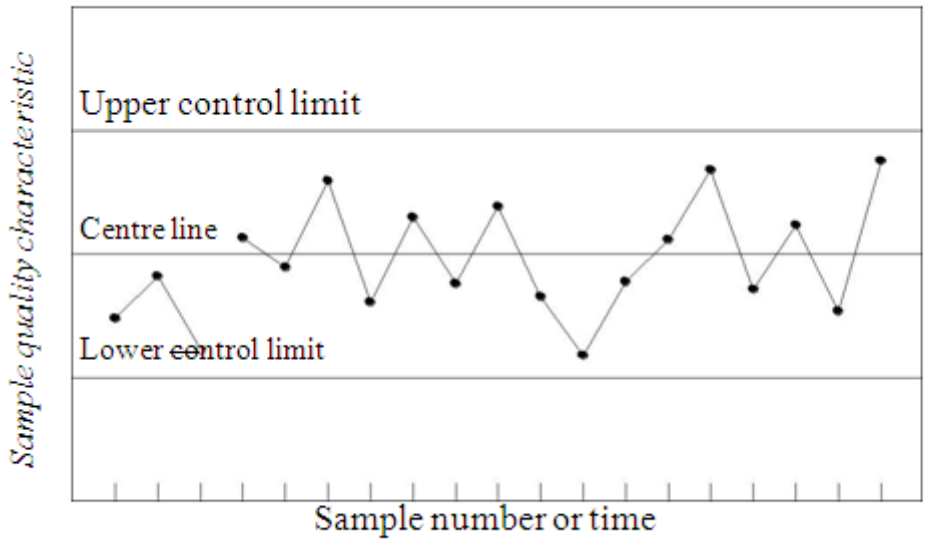
- Equipments
- Materials
- Environment
- Operator etc.

The **Control chart** is used to look at variations, seek assignable causes and chance causes. The control chart is a line chart with control limits.

All control charts have three basic components.

1. A centre line, usually the mathematical average of all the samples plotted.
2. Upper and Lower Control Limits that define the constraints of common cause variations.
3. Performance data plotted over time.

A typical control chart is a graphic display of a quality characteristic that has been measured or computed from a **sample** versus **sample number** or **time**. If the process is in control, nearly all of the sample points will fall between **Upper Control Limit (UCL)** and **Lower Control Limit (LCL).**



CONTROL CHART FOR VARIABLES

1. Mean chart – $\overline{X}$ chart & Range Chart – R Chart

$$\overline{\overline{X}} = \frac{\Sigma \overline{X}}{N}$$

$$\overline{R} = \frac{\Sigma R}{N}$$

Where, N = Total number of observations.
n = Sample size (for finding out the value of A_2 and D_4 and D_3 from the table)

Control limits for the charts are given by the following equation.

$\bar{X}$ – Chart		R - Chart	
CL	$= \bar{\bar{X}}$	CL	$= \bar{R}$
$UCL_{\bar{X}}$	$= \bar{\bar{X}} + A_2 . \bar{R}$	UCL_R	$= D_4 . \bar{R}$
$LCL_{\bar{X}}$	$= \bar{\bar{X}} - A_2 . \bar{R}$	LCL_R	$= D_3 . \bar{R}$

2. Mean chart – X chart & Standard Deviation chart – S Chart

$$\bar{\bar{X}} = \frac{\Sigma \bar{X}}{N}$$

$$\bar{S} = \frac{\Sigma S}{N}$$

Where, N = Total number of observations.
n = Sample size (for finding out the value of A_3 and B_4 and B_3 from the table)

Control limits for the charts are given by the following equation.

$\bar{X}$ – Chart		S - Chart	
CL	$= \bar{\bar{X}}$	CL	$= \bar{S}$
$UCL_{\bar{X}}$	$= \bar{\bar{X}} + A_3 . \bar{S}$	UCL_S	$= B_4 . \bar{S}$
$LCL_{\bar{X}}$	$= \bar{\bar{X}} - A_3 . \bar{S}$	LCL_S	$= B_3 . \bar{S}$

CONTROL CHART FOR ATTRIBUTES

1. p chart
2. np chart
3. c chart
4. u chart

POPULATION AND SAMPLE

In order to construct a frequency distribution of the outer diameter of shafts, a small portion (or) sample is selected to represent all the shafts. The population is the whole collection of shafts.

The population may be an hour‟ s production, a week‟ s production, 10000 pieces and so on.

It is not possible to measure all of the population. Hence, we go for sampling. Sampling becomes necessary

1. When it is impossible to measure the entire population.

2. When it is more expensive to observe all the data.

3. When the required inspection destroys the product.

4. When a test of the entire population may be too dangerous as in the case of new medical drug.

X is for sample average or sample mean.

μ is for population mean.

S is for sample standard deviation.

σ is for population standard deviation

SIX SIGMA

WHAT IS SIX SIGMA?

- **Six sigma** stands for six standard deviation from mean (sigma is the Greek letter used to represent standard deviation in statistics).
- Six sigma, similar to Zero Defect (ZD), is a philosophical benchmark or standard of excellence proposed by Philip Crosby.
- Six sigma methodology provides the techniques and tools to improve the capability and reduce the defects in any process.
- It was started by Motorola in 1987, in its manufacturing division.
- Six sigma strives for perfection. **It allows for only 3.4 defects per million opportunities (or 99.999666 percent accuracy).** Here a defect can be anything from a faulty party to an incorrect customer bill.
- Six sigma improves the process performance, decrease variation and maintains **consistent quality** of the process output. This leads to defect reduction and improvements in profits, product quality and customer satisfaction.
- Six sigma incorporates the basic principles and techniques used in business, statistics and engineering.

The objective of six sigma principle is to achieve zero defects products/process. It allows 3.4 defects per million opportunities.

WHY DO WE NEED SIX SIGMA?

(Three sigma quality is not enough. Why?)

We know that, the three sigma quality, i.e., the natural variability ($\bar{x} \pm 3\sigma$) is equal to tolerance (= upper specification limit – lower specification limit). It means, in normal distribution curve, only 0.27% of the output would be expected to fall outside the specifications limits.

The real meaning of 3σ concept: A medium aircraft consists of 10,000 different parts. At 3σ quality, 27 of those parts in an assembled aircraft would be defective. So three sigma quality level cannot be accepted as good enough quality level. So we have to increase the sigma level (i.e., reducing the number of defectives). In fact, even four sigma quality also not sufficient for the aircraft case. That's why six sigma quality level is preferred than 3σ and 4σ quality levels.

UNIT – IV

TQM TOOLS

BENCH MARKING

MEANING:

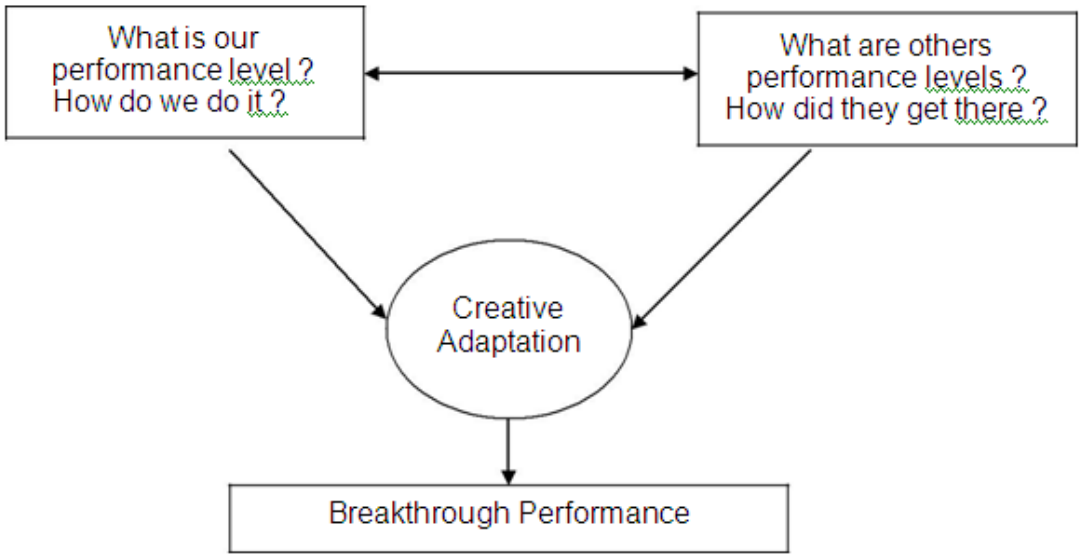
Bench marking is the process of determining who is the very best, who sets the standard, and what that standard is. In cricket, one could argue that two consecutive world cup champions made the Australian cricket team the benchmark.

Definition:

American productivity and quality centre has defined the benchmarking as "the process of identifying, understanding, and adopting outstanding practices and process from organizations anywhere in the world to an organization to improve its performance.

DAVID KEARNS defines benchmarking as "the continuous process of measuring products, services and practices against the toughest competitors or those companies recognized as industry leaders."

BENCHMARKING CONCEPT



Objectives of benchmarking:

1. Benchmarking aims at a goal setting process to facilitate comparison with the best.
2. It aims at motivating and stimulating company employees towards the goal of continuous quality improvement.
3. It aims at external orientation of the company
4. It aims at identifying a technological breakthrough
5. It aims at searching for industry best practices.

Types of Benchmarking

Classification based on the object to be benchmarked:

Product Benchmarking: this refers to comparison of different features and attributes of competing products and services.

Performance Benchmarking: this refers to comparison of performance indicators related to a business as a whole or to the group of critical activities or processes.

Process Benchmarking: this refers to comparison of processes. It identifies a more effective and efficient process to be implemented.

Strategic Benchmarking: this refers to examining competitive position in the market place. It helps the company to study the business strategy of another successful business and use the strategy for becoming more competitive.

Classification based on the organizations against whom one is Benchmarking:

1. Internal Benchmarking: it refers to comparison of performance between departments, plants, subsidiaries, within the organization.
2. Industry Benchmarking: It refers to comparison of performance by the organization
3. Competitive Benchmarking: It refers to comparison of performance against direct competitors.

4. Best in class Benchmarking: It refers to comparison of performance with best practices prevalent in an organization irrespective of products and services.

5. Relationship Benchmarking: it refers to comparison of performance with the Benchmarking Company which already has a relationship like customer-supplier relations, joint venture arrangement, etc.

Steps in benchmarking process:

Phase 1**: Planning:**

Step1: What can be benchmarked? (I.e., deciding what to benchmark)

Step2: To whom or what shall we compare (Identifying benchmark partners)

Step3: Determine data collection method and collect data

Phase 2: **Analysis:**

Step4: determine the current performance gap

Step 5: Project future performance levels

Phase 3**: Integration**:

Step6: communicate benchmark findings and gain acceptance.

Step7: **Establish functional goals**

Phase 4**: Action**

Step8: Develop action plans

Step9: Implements specific actions and monitor the progress

Step10: Recalibrate benchmarks

Phase 5: **Maturity:**

Step 11: Attain the leadership 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.

PITFALLS OF BENCHMARKING:

Bench marking is based on learning from others, rather that developing new and improved approaches. Since the process being studied is there for all to see , therefore a firm will find that benchmarking cannot give them a sustained competitive advantage. Although helpful benchmarking should never be the primary strategy for improvement.

If all the industries employ the benchmarking approach, it will lead to stagnation of ideas, strategies best industry practices, etc. so benchmarking should not be a substitute for innovation. It must be a mere improvement tool.

Definition:

Quality function development 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.

Quality function development 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.

BENEFITS OF QFD:

1. Improves customer satisfaction
2. Reduces implementation time.
3. Promotes teamwork
4. Provides documentation

The voice of the customer:

QFD begins with marketing to determine what exactly the customer desires from a product. The various sources for determining customer expectations are focus groups, surveys, complaints. Consultants, standards, and federal regulations. During the collection of information the QFD team must continually ask and answer numerous questions, such as:

What does the customer really want?

What are the customer's expectations?

Are the customer's expectations used to drive the design process?

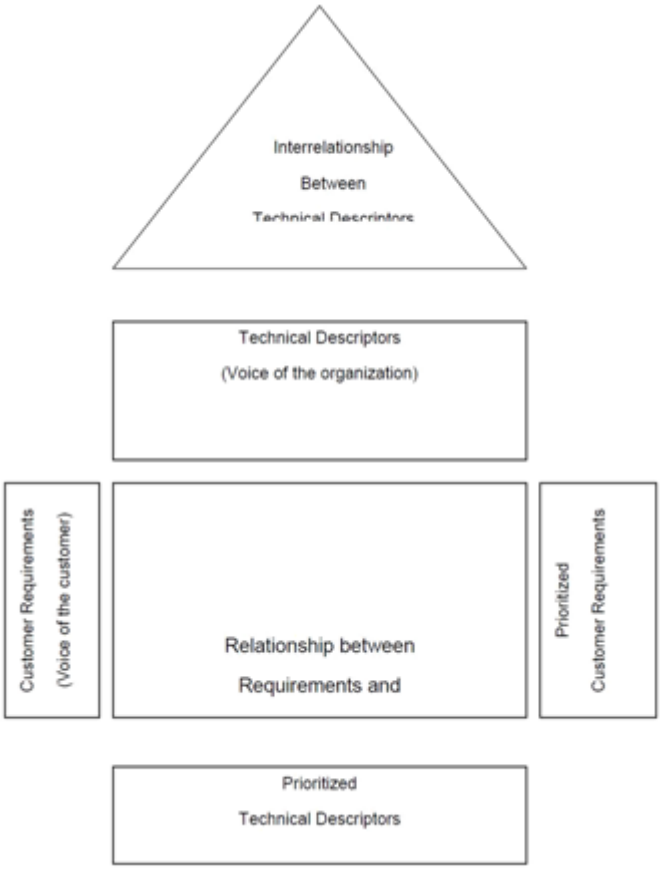
What can the design team do to achieve customer satisfaction?

INFORMATION ORGANIZATION:

Now that the customer expectations and needs have been identified and researched, the QFD team needs to process the information. Numerous methods include affinity diagrams, tree diagrams, and cause and effect diagrams. These methods are ideal for sorting large amounts of information. The affinity diagram which is ideally suited for most QFD applications

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.



Constructing the house of quality:

Step1: List customer requirements

Step2: List technical descriptors

Step3: Develop a relationship matrix between HOWS

Step4: competitive assessments

Step5: Develop prioritized customer requirements

Step6: Develop prioritized technical descriptors

QUALITY FUNCTION DEVELOPMENT PROCESS:

Phase 1: product planning

Step1: list customer requirements

Step2: List technical descriptors

Step3: Develop a relationship between WHATS AND HOWS

Step4: Develop a interrelationship matrix between HOWS

Step5: Do competitive assessments

Step6: Develop prioritized customer requirements

Step7: Develop prioritized technical descriptors.

Phase 2: part development

Step8: Deploy QFD process down to sub-components level both in terms of requirements and characteristics.

Step9: Deploy the component deployment chart. Relate the critical sub-component control characteristics.

Phase 3: process planning

Step10: Develop the relationship between the critical characteristics and process used to create the characteristics

Step11: Develop the control plan relating critical control to critical processes.

Phase 4: production planning

Step 12: Tabulate operating instructions from process requirements

Step13: develop prototype and do testing

Step14: Launch the final product to the market.

TAGUCHI'S QUALITY LOSS FUNCTION.

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"

LOSS FUNCTION:

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.

CONCEPT AND DEFINITION OF QUALITY COSTS

- **Concept:** Quality-related costs are costs incurred by an organization to ensure that the products / services it provides conform to customer requirements. In other words, quality costs are the sum of money spent on ensuring that customer requires are met and also the costs wasted through failing to achieve the desired level of quality. Thus quality cost is the cost of not meeting the customer's requirement. i.e., the cost of doing things wrong.
- The cost of quality is the difference between the actual cost of making and selling products / services and the cost of no failure.
- **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 customer and society.
- In simple word, quality cost is the cost of poor products or services.

FAILURE MODE AND EFFECT ANALYSIS (FMEA).

MEANING:

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 FMEA:

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

2. FMEA 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. FMEA is a before the event action and is done when existing systems products processes are changed or redesigned.
4. FMEA is a never ending process improvement tool.

Types of FMEA:

1. System FMEA
2. Design FMEA
3. Process FMEA
4. Service FMEA
5. Equipment FMEA
6. Maintenance FMEA
7. Concept FMEA
8. Environmental FMEA

Benefits of FMEA:

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
6. Document and track the actions taken to reduce risk
7. Provide focus for improved testing and development.
8. Minimize late changes and associated cost.
9. Act as catalyst for teamwork and idea exchange between functions.

STAGES OF FMEA.

The FMEA 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

The design of FMEA document:

1. FMEA number
2. item
3. Design responsibility
4. prepared by
5. model number/year
6. key date
7. FMEA date
8. Core team
9. Item function
10. potential failure mode
11. potential effects of failure
12. severity
13. classification
14. potential causes mechanisms of failure
15. occurrence
16. current design controls
17. detection
18. risk priority number
19. Recommend actions Responsibility and target completion dates
20. actions taken

The process of FMEA and documentation

1. process function requirements
2. potential failure mode
3. potential effects of failure
4. severity
5. classification
6. potential causes mechanisms of failure
7. occurrence
8. current process controls
9. detection

UNIT V

QUALITY SYSTEMS

ISO 9001

Design, Development, Production, Installation & Servicing

ISO 9002

Production, Installation & Servicing

ISO 9003

Inspection & Testing

ISO 9004

Provides guidelines on the technical, administrative and human factors affecting the product or services.

BENEFITS OF ISO 9000 STANDARDS:

- ✓ Achievement of international standard of quality.
- ✓ Value for money.
- ✓ Customer satisfaction.
- ✓ Higher productivity.
- ✓ Increased profitability
- ✓ Improved corporate image
- ✓ Access to global market
- ✓ Growth of the organization
- ✓ Higher morale of employees

CLAUSES (ELEMENTS) OF ISO 9000 (During the year 1987)

1. Management Responsibility

- ✓ Adequate resources for the verification activities

- ✓ Need for trained personnel
- ✓ Work and verification activities including audits
- ✓ A Management Representative to be identified
- ✓ Review the Quality System performance and customer complaints periodically

2. Quality System
3. Contract review
4. Design Control
5. Documents Control
6. Purchasing
7. Purchaser – Supplied Product
8. Product Identification and Traceability
9. Process Control
10. Inspection and Testing
11. Inspection and Test Status
12. Control of Non – Conforming Product
13. Corrective Action
14. Handling, Storage, Packaging and Delivery
15. Quality Records
16. Internal Quality Audits
17. Training
18. Servicing
19. Statistical Techniques

CLAUSES (ELEMENTS) OF ISO 9000 (During the year 2000)

1. Scope
2. Normative Reference
3. Terms and Definitions
4. Quality Management System (QMS)
   - 4.1 General Requirements
   - 4.2 Documentation
5. Management Responsibility
   - 5.1 Management Commitment
   - 5.2 Customer Focus
   - 5.3 Quality Policy
   - 5.4 Planning
   - 5.5 Responsibility, Authority and Communication
   - 5.6 Management Review
6. Resource Management
   - 6.1 Provision of Resources
   - 6.2 Human Resources
   - 6.3 Infrastructure
   - 6.4 Work Environment
7. Product Realization
   - 7.1 Planning of Product Realization
   - 7.2 Customer related processes
   - 7.3 Design and Development
   - 7.4 Purchasing
   - 7.5 Production and Service Provision
   - 7.6 Control of Monitoring and Measuring devices
8. Monitoring and Measurement
   - 8.1 General
   - 8.2 Monitoring and Measurement

8.3 Control of Non-Conforming Product
8.4 Analysis of Data
8.5 Improvement

IMPLEMENTATION OF QUALITY MANAGEMENT SYSTEM :

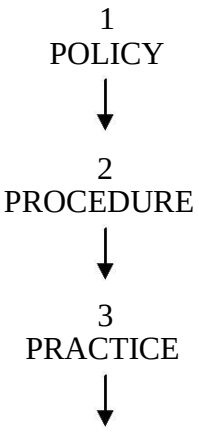
1. Top Management Commitment
2. Appoint the Management Representative
3. Awareness
4. Appoint an Implementation Team
5. Training
6. Time Schedule
7. Select Element Owners
8. Review the Present System
9. Write the Documents
10. Install the New System
11. Internal Audit
12. Management Review
13. Pre-assessment
14. Registration

PITFALLS OF SUCCESSFUL IMPLEMENTATION :

1. Using a generic documentation program or another organization's documentation program
2. Over-documentation or documentation that is too complex
3. Using External Consultants without involvement
4. Neglecting to obtain top management's involvement
5. Developing a system that does not represent what actually occurs

DOCUMENTATION

In every organization, the quality system must be documented properly. The documentation of the system can be seen as a hierarchical format as shown.



4
PROOF

QUALITY AUDITING

The term Audit refers to a regular examination and checking of accounts or financial records, settlement or adjustment of accounts.

It also refers to checking, inspection and examination of Production Processes.

PURPOSE OF QUALITY AUDIT :

- To establish the adequacy of the system.
- To determine the effectiveness of the system.
- To afford opportunities for system analysis.
- To help in problem solving.
- To make decision making easier etc.

TYPES OF QUALITY AUDIT :

1. First Party Audit.
2. Second Party Audit.
3. Third Party Audit.

Quality audit can also be classified on the basis of the area taken into account for the audit such as

- System Audit.
- Process Audit.
- Product Audit.
- Adequacy Audit.
- Compliance Audit.

IMPLEMENTATION OF QUALITY MANAGEMENT SYSTEM:

1. Top Management Commitment

2. Appoint the Management Representative

3. Awareness

4. Appoint an Implementation Team

5. Training

6. Time Schedule

7. Select Element Owners

8. Review the Present System

9. Write the Documents

10. Install the New System

11. Internal Audit

12. Management Review

13. Pre-assessment

14. Registration

ISO 14000 – ENVIRONMENTAL MANAGEMENT SYSTEM

The overall aim of the Environmental Management systems is **to provide protection to the environment** and **to prevent pollution.**

- The success of ISO 9000 along with increased emphasis on Environmental issues were instrumental in ISO's decision to develop Environmental Management Standards.
- In 1991, ISO formed the Strategic Advisory Group on the Environment (SAGE) which led to the formation of Technical Committee (TC) 207 in 1992.
- Mission of TC207 is to develop standards for an Environmental Management System (EMS) which was identified as ISO 14000.
- TC 207 has Established six sub-committees
    1. Environmental Management System (EMS)
    2. Environmental Auditing (EA)
    3. Environmental labeling (EL)
    4. Environmental Performance Evaluation (EPE)
    5. Life-Cycle Assessment (LCA)
    6. Terms & Definitions

Environmental Management System (EMS) :

EMS has two Evaluation Standards. They are

1. Organization Evaluation Standards
2. Product Evaluation Standards

REQUIREMENT OF ISO 14001

There are six elements

1. GENERAL REQUIREMENTS

- EMS should include policy, planning implementation & operation, checking & corrective action, management review.

2. ENVIRONMENTAL POLICY (Should be based on mission)

- The policy must be relevant to the organization's nature.
- Management's Commitment (for continual improvement & preventing pollution).
- Should be a framework (for Environmental objectives & Targets).
- Must be Documented, Implemented, & Maintained.

3. PLANNING

- Environmental Aspects
- Legal & other Requirements
- Objectives & Targets
- Environmental Management Programs

4. IMPLEMENTATION & OPERATION

- Structure & Responsibility
- Training, Awareness & Competency
- Communication
- EMS Documentation
- Document Control
- Operational Control
- Emergency Preparedness & Response

5. CHECKING & CORRECTIVE ACTION

- Monitoring & Measuring
- Nonconformance & Corrective & Preventive action
- Records
- EMS Audit

6. MANAGENMENT REVIEW

- Review of objectives & targets
- Review of Environmental performance against legal & other requirement
- Effectiveness of EMS elements
- Evaluation of the continuation of the policy

BENEFITS OF ENVIRONMENTAL MANAGEMENT SYSTEM

GLOBAL BENEFITS

- Facilitate trade & remove trade barrier
- Improve environmental performance of planet earth
- Build consensus that there is a need for environmental management and a common terminology for EMS

ORGANIZATIONAL BENEFITS

- Assuring customers of a commitment to environmental management
- Meeting customer requirement
- Improve public relation
- Increase investor satisfaction
- Market share increase
- Conserving input material & energy
- Better industry/government relation
- Low cost insurance, easy attainment of permits & authorization

Two Marks Questions and Answers:
UNIT-I INTRODUCTION

1. Define Total Quality Management

TQM is defined as a philosophy and a set of guiding principles that represent the foundation of a continuously improving organization.

It is the application of quantitative methods and human resources to improve all the processes within an organization and exceed customer needs now and in the future. It integrates fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach.

2. Define Quality

1. Quality is defined as the predictable degree of uniformity and dependability, at low cost suited to the market. – Deming
2. Quality is defined as fitness for use - Juran
3. Quality is defined as conformance to requirements - Crosby
4. Quality is totality of the characteristics of entity that bear on its ability to satisfy Stated and implied needs - ISO

3. What are the Dimensions of Quality?

- Features
- Conformance
- Reliability
- Durability
- Service
- Response
- Aesthetics
- Reputation

4. Give the Basic Concepts of TQM

- A committed and involved management to provide long-term top-to-bottom organizational support.
- An unwavering focuses on the customer, both internally and externally.
- Effective involvement and utilization of the entire work force.
- Continuous improvement of the business and production process.
- Treating suppliers as partners.
- Establish performance measures for the processes

5. Give the Obstacles associated with TQM Implementation.

• Lack of management commitment
• Inability to change organizational culture
• Improper planning
• Lack of continuous training and education
• Incompatible organizational structure and isolated individuals and departments
• Ineffective measurement techniques and lack of access to data and results.
• Paying inadequate attention to internal and external customers.
• Inadequate use of empowerment and teamwork.

6. Give the Analysis Techniques for Quality Costs

1. Trend Analysis
2. Pareto Analysis

7. Define Quality Costs

Quality Costs are defined as those costs associated with the non achievement of product or service quality as defined by the requirements established by the organization and its contracts with customers and society.
Quality cost is defined as cost of producing poor quality products or services offered.

8. Give the primary categories of Quality cost.

• Preventive cost category
• Appraisal cost category
• Internal failure cost category
• External failure cost category

9. Define Quality Planning

A quality plan sets out the desired product qualities and how these are assessed and define the most significant quality attributes. It should define the quality assessment process. It should set out which organizational standards should be applied and, if necessary, define new standards.

10. What are the general duties of a quality council?

(i) Develop, with input from all personnel, the core values, vision statement, mission statement, and quality policy statement. (ii)Develop the strategic long-term plan with goals and the annual quality improvement program with objectives. (iii)Create the total education and training plan. (iv) Determine and continually monitor the cost of poor quality. (v)Determine the performance measures for the organization, approve those for the functional areas, and monitor them. (vi) Continually, determine those projects that improve the processes, particularly those that affect external and internal customer satisfaction

11. What are the various quality statements?

1. Vision Statement
2. Mission Statement
3. Quality Policy Statement

12**. What is a mission statement?**

The mission statement answers the following questions: who we are, who are the customers, what we do, and how we do it.

13. **What is a vision statement?**

The vision statement is a declaration of what an organization should look like five to ten years in a future.

14. List out the names the Quality Gurus

Deming, Juran, Ishikawa, Shewart, Feigenbaum, Taguchi.

15. Tabulate the tangible and intangible benefits of TQM.

Tangible Benefits	Intangible Benefits
Improved product quality	Improved employee participation
Improved productivity	Improved teamwork
Reduced quality costs	Improved working relationships
Increased market and customers	Improved customer satisfaction
Increased profitability	Improved communication
Reduced employee grievances	Enhancement of job interest
	Enhanced problem-solving

	capacity Better company image.

15. What do you mean by the term leadership?

Leadership is the process pf influencing the activities of an individual or a group towards the achievement of a goal in a given situation.

16. List out the different leadership roles required for effective teamwork.

The eight leadership roles are:
1. Producer role
2. Director role
3. Coordinator role
4. Checker role
5. Stimulator role
6. Mentor role
7. Innovator roles and
8. Negotiator role.

17. What is a quality council? Who are all the members in the quality council?

A quality council is a team to provide overall direction for achieving the total quality culture.
The members of quality council are

(i) The chief executive officer (CEO)
(ii) The senior managers of the different functional areas and
(iii) A coordinator or consultant.

18. List out any four barriers to TQM implementation.

The four barriers to TQM implementation are
1. Lack of management commitment.
2. Lack of employees commitment.
3. Lack of effective communication.
4. Lack of continuous training and education.

19. What are the pillars of TQM?

The four pillars of TQM are:
1. Problem solving discipline
2. Interpersonal skills
3. Teamwork and
4. Quality improvement process.

20. What are the elements of external failure?

The elements of external failures are

1. Cost of processing complaints from customers.
2. Cost of commissioning failure.
3. Costs of servicing are replacing the defective items.
4. Cost of guarantee and warranty claims
5. Cost of lost goodwill of customers.

UNIT –II TQM PRINCIPLES

1. What are the important factors that influenced purchases?

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

2. Give the need for a feedback in an organization?

- Discover customer dissatisfaction
- Discover relative priorities of quality.
- Compare performance with the competition.
- Identify customer's needs.
- Determine opportunities for improvement.

3. List the tools used for feedback?

• Comment cards
• Surveys
• Focus groups
• Toll-free telephone lines
• Customer visits
• Report cards
• The internet
• Employee feedback
• American Customer Satisfaction Index

4**. Define Customer Retention**

Customer retention represents the activities that produce the necessary customer satisfaction that creates customer loyalty, which actually improves the bottom line. It is the nexus between the customer satisfaction and the bottom line.

5. Define Employee Involvement

Employee involvement is a means to better meet the organization's goal for quality and productivity at all levels of an organization.

6. State Maslow's Hierarchy of Needs?

1. Survival of Security
2. Social
3. Esteem
4. Self-actualization

7. State Frederick Herzberg's Two-factor theory?

Herzberg found that people were motivated by recognition, responsibility, achievement and the work itself.

8. Define Empowerment

Empowerment means invest people with authority. Its purpose is to tap the enormous reservoir of creativity and potential contribution that lies within every worker at all levels. 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 to initiate the necessary steps to satisfy customer requirements within well-defined boundaries in order to achieve organizational values an goals.

9. What are the types of teams?

- Process improvement team
- Cross-functional team
- Natural work teams and Self-directed/self-managed work teams

10. What are the characteristics of successful teams?

• Sponsor • Team charter • Team composition • Training • Ground rules • Clear objectives
• Accountability • Well-defined decision procedures • Resources • Trust

11. Give some common team problems?

• Floundering • Overbearing participants • Dominating participants
• Reluctant participants • Unquestioned acceptance of opinions as facts • Rush to accomplish
• Attribution • Discounts and "plops" • Wanderlust : digression and tangents

12. What are the common barriers to team progress?

• Insufficient training • Incompatible rewards and compensation • First-line supervisor resistance • Lack of planning • Lack of management support • Access to information systems
• Lack of union support

13. Define Recognition and Reward?

Recognition is a form of employee motivation in which the organization publicly acknowledges the positive contributions an individual or team has made to the success of the organization. Reward is something tangible to promote desirable behavior. Recognition and reward go together to form a system for letting people know they are valuable members of the organization.

14. What are the benefits of employee involvement?

Employee Involvement improves quality and increases productivity because
• Employees make better decisions
• Employees are more likely to implement and support decisions they had a part in making.
• Employees are better able to spot and pinpoint areas for improvement.
• Employees are better able to take immediate corrective action.

15**. What are the basic ways for a continuous process improvement?**

• Reduce resources • Reduce errors • Meet or exceed expectations of downstream customers
• Make the process safer • Make the process more satisfying to the person doing it.

16. What are the three components of the Juran Trilogy?

• Planning • Control • Improvement

17. What are the steps in the PDSA cycle?

The basic Plan-Do-Study-Act is an effective improvement technique.
1. Plan carefully what is to be done
2. Carry out the plan
3. Study the results
4. Act on the results by identifying what worked as planned and what didn't.

18**. What are the phases of a Continuous Process Improvement Cycle?**

a) Identify the opportunity b) Analyze the process c) Develop the optimal solutions d) Implement e) Study the results f) Standardize the solution g) Plan for the future

19. Define 5S

5S Philosophy focuses on effective work place organization and standardized work procedures. 5S simplifies your work environment, reduces waste and non-value activity while improving quality efficiency and safety.

20. What is a Kaizen?

Kaizen is a Japanese word for the philosophy that defines management's role in continuously encouraging and implementing small improvements involving everyone. It is the process of continuous improvement in small increments that make the process more efficient, effective, under control and adaptable.

21. What are the three types of sourcing?

• Sole sourcing • Multiple sourcing • Single sourcing

22. Give the six basic techniques for presenting performance measures?

a) Time series graph b) Control chart c) Capability indexd) Taguchi's Loss Function e) Cost of poor quality f) Malcolm Baldrige National Quality Award

UNIT – III STATISTICAL PROCESS CONTROL

1. Define Statistics

Statistics is defined as the science that deals with the collection, tabulation, analysis, interpretation, and presentation of quantitative data.

2. What is a measure of central tendency?

A measure of central tendency of a distribution is a numerical value that describes the central position of the data or how the data tend to build up in the center. There are three measures in common in use in quality viz, the average, the median and the mode.

3. What is Measures of dispersion?

Measures of dispersion describe how the data are spread out or scattered on each side of the central value. The measures of dispersion used are range and standard deviation.

4. What is a normal curve?

The normal curve is a symmetrical, unimodal, bell-shaped distribution with the mean, median and mode having the same value.

5. What is the use of the control chart?

The control chart is used to keep a continuing record of a particular quality characteristic. It is a picture of process over time.

6. Give the objectives of the attribute charts.

- Determine the average quality level.
- Bring to the attention of management any changes in the average.
- Improve the product quality.

• Evaluate the quality performance of operating and management personnel.
• Determine acceptance criteria of a product before shipment to the customer.

7. Define Six Sigma Problem Solving Method?

Define - improvement opportunity with an emphasis on increasing customer satisfaction.
Measure - determine process capability (Cp/ Cpk) & Defects per million opportunities.
Analyze- identify the vital few process input variables that affect key product
Improve - Make changes to process settings, redesign processes, etc. to reduce the number of defects of key output variables.
Control - Implement process control plans; install real-time process monitoring tools to standardize processes to maintain levels.

8. What are the new seven management tools?

i. Affinity Diagram ii. Interrelationship Digraph iii. Tree Diagram iv. Matrix Diagram v.Prioritization Matrices vi. Process Decision Program Chart vii. Activity Network diagram

9. Give the seven tools of quality?

• Pareto Diagram
• Process Flow Diagram
• Cause-and-Effect Diagram
• Check Sheets
• Histogram
• Control Charts
• Scatter Diagrams

10.Give the usage of C&E diagrams?

• Analyze actual conditions for the purpose of product or service quality improvement, more efficient use of resources, and reduced costs.
• Eliminate conditions causing nonconformities and customer complaints.
• Standardize existing and proposed operations.
• Educate and train personnel in decision-making and corrective-action activities.

11. Define Six Sigma?

Six-Sigma is a business process that allows organizations to drastically improve their bottom line by designing and monitoring every day business activities in ways that minimize waste and resources while increasing customer satisfaction. It is achieved through continuous process measurement, analysis & improvement.

12. What are the various histogram shapes?

1. Symmetrical
2. Skewed right
3. Skewed left
4. Peaked
5. Flat
6. Bimodal
7. Plateau distribution
8. Comb distribution
9. Double peaked distribution

13. Differentiate Population & Sample?

Population represents the mathematical world and Sample represents the real world. A population frequency distribution is represented by a smooth curve whereas a sample frequency distribution is represented by a histogram.

14. Give the sources of variation?

1. Equipment
2. Material
3. Environment
4. Operator

15. Define Run chart?

A run chart is a very simple technique for analyzing the process in the development stage or, for that matter, when other charting techniques are not applicable.

16. Define Control chart?

Control chart is a means of visualizing the variations that occur in the central tendency and the dispersion of a set of observations. It is a graphical record of the quality of a particular characteristic.

17. What are the various patterns of scatter diagrams?

1. Positive correlation
2. Negative correlation
3. No correlation
4. Negative correlation may exist
5. Correlation by stratification
6. Curvilinear relationship

18. What is the procedure for constructing the tree diagram?

1. Choose an action –oriented objective statement from the interrelationship diagram, affinity diagram, brainstorming, team mission statement, and so forth.
2. Using brainstorming, choose the major headings.
3. Generate the next level by analyzing the major headings.

19. Give atleast five standard formats of matrix diagram?

1. L-shaped
2. T-shaped
3. Y-shaped
4. C-shaped
5. X-shaped

20. What are the benefits of an activity network diagram?

1. A realistic timetable determined by the users.
2. Team members understand the role in the overall plan.
3. Bottlenecks can be discovered and corrective action taken.
4. Members focus on the critical tasks.

UNIT-IV TQM TOOLS

1. Define Benchmarking?

Benchmarking is a systematic method by which organizations can measure themselves against the best industry practices. The essence of benchmarking is the process of borrowing ideas and adapting them to gain competitive advantage. It is a tool for continuous improvement.

2. Enumerate the steps to benchmark?

a) Decide what to benchmark b) Understand current performance c) Plan d) Study others e) Learn from the data f) Use the findings

3. What are the types of benchmarking?

i. Internal ii. Competitive iii. Process

4. What is a QFD?

Quality Function Deployment is a planning tool used to fulfill customer expectations. It is a disciplined approach to product design, engineering, and production and provides in-depth evaluation of a product.

5. What are the benefits of QFD?

i. Customer driven ii. Reduces implementation time iii. Promotes teamwork iv. Provides documentation

6. What are the steps required to construct an affinity diagram?

i. Phrase the objective ii. Record all responses iii. Group the responses iv. Organize groups in an affinity diagram

7. What are the parts of house of quality?

i. Customer requirements ii. Prioritized customer requirements iii. Technical descriptors iv.

Prioritized technical descriptors v. Relationship between requirements and descriptors vi. Interrelationship between technical descriptors

8. How will you build a house of quality?

a) List customer requirements b) List technical descriptors c) Develop a relationship matrix between WHATs and HOWs\ d) Develop an interrelationship matrix between HOWs e) Competitive assessments f) Develop prioritized customer requirements g) Develop prioritized technical descriptors

9. Define FMEA?

Failure Mode Effect Analysis is an analytical technique that combines the technology and experience of people in identifying foreseeable failure modes of a product or process and planning for its elimination.

10. What are the stages of FMEA?

1. Specifying possibilities a. Functions b. Possible failure modes c. Root causes d. Effects e. Detection/Prevention 2. Quantifying risk a. Probability of cause b. Severity of effect c. Effectiveness of control to prevent caused. Risk priority number 3. Correcting high risk causes a. Prioritizing work b. Detailed action c. Assigning action responsibility d. Check points on completion 4. Revaluation of risk a. Recalculation of risk priority number

11. What are the goals of TPM?

The overall goals of Total Productive Maintenance, which is an extension of TQM are i. Maintaining and improving equipment capacity ii. Maintaining equipment for life iii. Using support from all areas of the operation iv. Encouraging input from all employees v. Using teams for continuous improvement

12. Give the seven basic steps to get an organization started toward TPM?

a) Management learns the new philosophy b) Management promotes the new philosophy c) Training is funded and developed for everyone in the organization d) Areas of needed improvement are

identified e) Performance goals are formulated f) An implementation plan is developed g) Autonomous work groups are established

13. What are the major loss areas?

i. Planned downtime ii. Unplanned downtime iii. Idling and minor stoppages iv. Slow-downs v. Process nonconformities vi. Scrap

14. What are the generic steps for the development and execution of action plans in benchmarking?

1. Specify tasks.
2. Sequence tasks.
3. Determine resource needs.
4. Establish task schedule.
5. Assign responsibility for each task.
6. Describe expected results.
7. Specify methods for monitoring results.

15. What are the phases of QFD process?

i. Product planning ii. Part development iii. Process planning iv. Production planning

16. What are the several types of FMEA?

1. Design FMEA
2. Process FMEA
3. Equipment FMEA
4. Maintenance FMEA
5. Concept FMEA
6. Service FMEA
7. System FMEA
8. Environment FMEA etc.

17. Define TPM?

T : Total = All encompassing by maintenance and production individuals working together. P : Productive = Production of goods and services that meet or exceed customer's expectations. M :

Maintenance = Keeping equipment and plant in as good as or better than te original condition at all times.

18. List out any four benefits of benchmarking.

The benefits of competitive benchmarking include:
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 d evaluating the not-invented-here syndrome.

UNIT-V QUALITY SYSTEMS

1. Give the ISO 9000 Series of Standards?

• ISO 9000, "Quality Management and Quality Assurance Standards Guidelines for Selection and Use".
• ISO 9001, "Quality Systems – Model for Quality Assurance in Design, Development, Production, Installation & Servicing".
• ISO 9002, "Quality Systems – "Model for Quality Assurance in Production, Installation & Servicing".
• ISO 9003, "Quality Systems – "Model for Quality Assurance in Final Inspection and Test".
• ISO 9004-1, "Quality Management and Quality System Elements – Guidelines".

2. What is the need for ISO 9000?

ISO 9000 is needed to unify the quality terms and definitions used by industrialized nations and use terms to demonstrate a supplier's capability of controlling its processes.

3. Give some other quality systems.

i. QS-9000 ii. TE-9000 iii. AS9000

4. Give the objectives of the internal audit.

a) Determine the actual performance conforms to the documented quality systems. b) Initiate corrective action activities in response to deficiencies. c) Follow up on noncompliance items of

previous audits. d) Provide continued improvement in the system through feedback to management.e) Cause the auditee to think about the process, thereby creating possible improvements.

5. What are the requirements of ISO 14001?

i. General requirements ii. Environmental policy iii. Planning iv. Implementation and operation v. Checking and corrective action vi. Management review

6. What are the benefits of ISO 14000?

a. Global
1. Facilitate trade and remove trade barriers
2. Improve environmental performance of planet earth
3. 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

7. What are the four elements for the checking & corrective action of ISO 14001?

a) Monitoring and measuring b) Nonconformance and corrective and preventative action c) Records d) EMS audit

8. What are the seven elements for the implementation & operations of ISO 14001?

a) Structure and responsibility b) Training, awareness and competency c) Communication d) EMS documentation e) Documentation control f) Operational control g) Emergency preparedness and response

9. What are the four elements for the planning of ISO 14001?

a) Environmental aspects b) Legal and other requirementsc) Objectives and targets d) Environmental Management Programs

10. Give the types of Organizational Evaluation Standards?

• Environmental Management System
• Environmental Auditing
• Environmental Performance Evaluation

11. Give the types of Product Evaluation Standards?

• Environmental Aspects in Product Standards
• Environmental Labeling
• Life-Cycle Assessment

12. Define Quality Audits?

Quality Audits examine the elements of a quality management system in order to evaluate how well these elements comply with quality system requirements.

13. Analyze TQM?

Total= Made up of the whole.
Quality = Degree of excellence a product or service provides.
Management = Act, art or manner of handling, controlling, directing etc.

14. What are the benefits of ISO?

1. Fewer on-site audit by customers.
2. Increased market share.
3. Improved quality, both internally and externally.
4. Improve product and service quality levels from suppliers.
5. Greater awareness of quality by employees.
6. A documented formal systems.
7. Reduced operating costs.

15. Give the ISO 9001 requirements?

1. Scope
2. Normative Reference
3. Terms and Definitions

4. Quality Management System
5. Management Responsibility
6. Resource Management
7. Product Realization
8. Measurement, Analysis & Improvement

16. What are the methods of actual audit?

i. Examination of documents ii. Observation of activities iii. Interviews

17. Define Run chart?

A run chart is a very simple technique for analyzing the process in the development stage or, for that matter, when other charting techniques are not applicable.

18. Define Control chart?

Control chart is a means of visualizing the variations that occur in the central tendency and the dispersion of a set of observations. It is a graphical record of the quality of a particular characteristic.

19. What are the various patterns of scatter diagrams?

Positive correlation
Negative correlation
No correlation
Negative correlation may exist
Correlation by stratification
Curvilinear relationship

20. **Give atleast five standard formats of matrix diagram?**

L-shaped
T-shaped
Y-shaped
C-shaped
X-shaped

KARPAGAM UNIVERSITY

Coimbatore 21.
FACULTY OF ENGINEERING

B.E. – AERONAUTICAL ENGINEERING (Full time) - VII Semester

END SEMESTER EXAMINATION November 2013

Subject Code : 10BEAR705 **Maximum Marks: 100**
Subject Name : Total Quality Management **Time Duration: 03 Hrs.**
Date of Exam : 28.11.2013

Part A: Answer all the Questions (20 x 01 = 20 Marks)

1. Ishikawa diagram is
a) Scatter Diagram b) Pareto Diagram **c) Cause and Effect Diagram** d) Control chart
Ans. (c)

2. According to TQM, Suppliers should be treated as_____
a) Owners b) Employees
c) Partners d) Leaders
Ans. (c)

3. The probability of a product's failing within a specified period of time is _____
a) Conformance **b) Reliability**
c) Durability d) Service
Ans. (b)

4. Basic needs include
a) Food, clothing, shelter b) shelter, warmth, self-defense
c) Friendship, love, respect d) status, recognition, responsibility
Ans. (a)

5. The word SEITON means that
a) Tidiness **b) orderliness**
c) Cleanliness d) discipline
Ans. (b)

6. External Failure cost includes
a) Education and Training b) Inspection and Product Auditing
c) Rework and Scrap **d) Warranty and Customer complaint**
Ans. (d)

7. Strategic planning includes
a) Customer needs b) customer positioning
c) Predict the future **d) all of the given options** **Ans. (d)**

8. _____ is the process of stimulating people inner drives and action towards certain goals and committing his energies to achieve these goals.
a) Recognition b) Empowerment
c) Recommendation **d) Motivation**
Ans. (d)

9. The value which occurs most frequently is ____
a) Mean b) Median
c) Mode d) Range **Ans. (c)**

10. Six sigma was started by _____in 1987
a) Deming b) General motors
c) Motorola d) Hindustan motors **Ans. (c)**

11. PDPC stands for
a) Process decision programme chart b) process development programme chart
c) programme development process chart d) process development programme chart
Ans. (a)

12. The objective of the six sigma is _____
a) Zero defect b) No accident
c) No error d) Allowable error
Ans. (a)

13. The first and foremost planning tool used in QFD is the
a) Quality In House **b) House of quality**
c) Quality houses d) relationship matrix
Ans. (b)

14. FMEA is a …….. technique
a) Analytical b) graphical
c) Analytical & Graphical d) none of the given options
Ans. (a)

15. Putting one's leg into other's shoe is categorized as
a) Enrichment b)Empowerment **c) Empathy** d) Encouragement
Ans. (c)

16. Juran's Trilogy means
a) Quality Planning, Q.Control, Q.Improvement b) Q.planning, Q.goals, Q.Target
c) Q.delivery, Q.Service, Q.Supplier d) Q.Planning, Q.improvement,Q.measurement,
Ans. (a)

17. The ISO 14000 family is primarily concerned with
a) Marketing management b) Quality management
c) Environmental management d) Personnel management **Ans. (c)**

18**.** ISO 9001-2000 describes the
a) QMS-Fundamentals and vocabulary b) QMS- Requirements
c) QMS-Guidance for performance improvement **d) All of the given options**
Ans. (d)

19. ISO stands for
a) International Stability Organisation **b) International organization for standardisation**
c) Indian organization for standards d) none of the given options **Ans. (b)**

20. In Quality Management System, the audits can be classified into
a) System audit b) Process and product audit
c) Compliance audit **d) All of the given options** **Ans. (d)**

PART B: ANSWER ALL THE QUESTIONS (05 x 16 = 80 Marks)

21. a) Explain the meaning of Quality according to Quality Gurus and ISO. Describe the different types of Quality Costs.

Quality can be defined as 'conformance to requirements', 'fitness for use' and 'customer satisfaction'. Quality refers to the ability of a product or service to consistently meet or exceed customer expectations.

GURUS OF TQM: Definition of Quality

JURAN - 'Fitness for use'

CROSBY - 'Conformance to requirements'

DEMING - 'A predictable degree of uniformity and dependability at low cost and suited to the market'

FEIGANBAUM - 'Quality is in essence, a way of managing the organisation'

ISO - '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'

QUALITY COSTS:

- 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 a cost for poor product of service.

ELEMENTS OF QUALITY COST:-

- Cost of prevention
- Cost of appraisal
- Cost of internal failures and external failures

PREVENTION COST

- Marketing / Customer / User.
- Product / Service / Design Development.
- Purchasing
- Operations (Manufacturing or Service)
- Quality Administration.

APPRAISAL COST

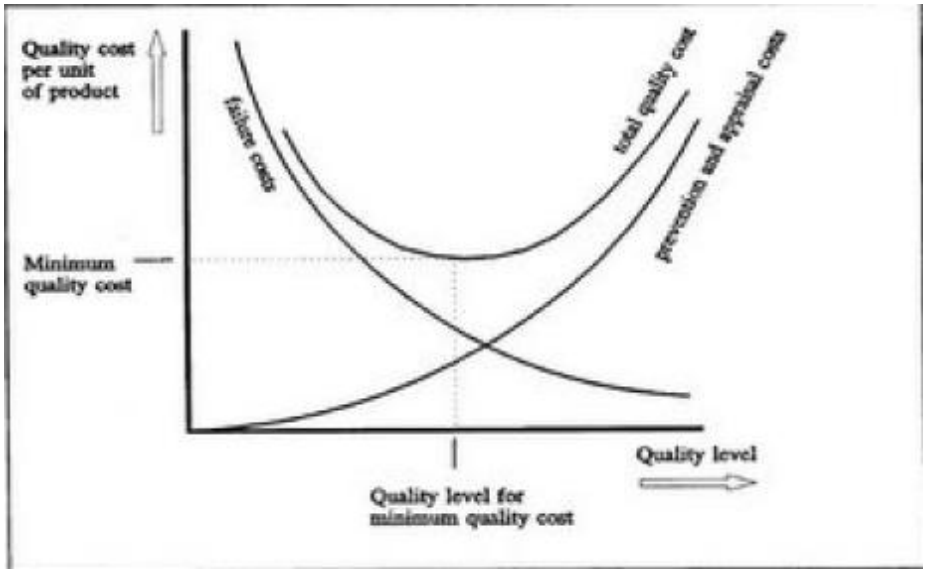
- Purchasing Appraisal Costs.
- Operations Appraisal Costs
- External Appraisal Costs
- Review of Test and Inspection Data
- Miscellaneous Quality Evaluations

INTERNAL FAILURE COST

- Product or Service Design Failure Costs (Internal)
- Purchasing Failure Costs
- Operations (Product or Service) Failure Costs

EXTERNAL FAILURE COST

- Complaint Investigations of Customer or User Service
- Returned Goods
- Retrofit and Recall Costs
- Warranty Claims
- Liability Costs
- Penalties
- Customer or User Goodwill
- Lost Sales



b) Define Leadership. Describe the characteristics and qualities of good Leaders.

The process of influencing others towards the accomplishment of goals. Leadership is the ability to positively inspire people to make a total willing and voluntary commitment to accomplish organizational goals. Leaders will guide to do, shows the direction and guide the group members towards the accomplishment of goals.

Characteristics of quality leaders

1.Customers first : Giving priority to customers and their needs

2.Value people

3.Build suppler partnership

4.Empowering rather than controlling subordinates

5.Strive for excellence

6.Demonstrate involvement / commitment

7.Explain & deploy policy

8.Continuous dissemination of information about TQM through effective communication

9.Promote teamwork through quality circles, work groups, project teams

10.Benchmark continuously

11.Encourage collaboration

12. Recognising and celebrating team success.

Requirements of Effective Leadership:

1.Vision: It is crucial for leaders during times of change. Leaders recognize the radical organizational changes taking place today as opportunities to achieve total quality.

2. Empowerment: Leaders empower employees to assume ownership of problems or opportunities and to be proactive in implementing improvements and making decisions in the best interests of the organization.

3. Intuition: Leaders usually follow their intuition. They must be prepared to make difficult decisions even in the face of uncertainty and change and anticipate the future.

4. **Self-understanding**: It requires the ability to look at one's self and then identify relationships with employees and within the organization. It requires an examination of one's weaknesses as well as strengths.

5. Value congruence: Value congruence occurs when leaders integrate their values into the company's system. Values are basic assumptions and beliefs about he nature of the business, mission, people and relationships of an organization. Values include trust and respect of individuals, openness, teamwork, integrity and commitment to quality.

22.a) Explain the importance of Employee involvement in implementing TQM and discuss on Maslow's Hierarchy of Needs theory.

In order to meet the organization's goal of quality and productivity at all levels of an organization, it is necessary that employees at all levels are utilized effectively and efficiently to obtain better quality and productivity respectively in the organization. Involving employees improves quality of the product and increases productivity because of the following reasons:

- Employee involvement increases employee morale and commitment to the organization
- It develops the skills and leadership capability of individuals
- It promotes creativity and innovation which are the basis of competitive advantage
- Allows employees to solve problems at the source immediately

Maslow's Hierarchy of Needs is a popular way of thinking about people's needs. Published by psychologist Abraham Maslow in his 1943 article, "A Theory of Human Motivation," this theory contends that as humans strive to meet our most basic needs, we also seek to satisfy a higher set of needs.

MASLOW'S HIERARCHY OF NEEDS

Maslow presents this set of needs as a hierarchy, consisting of:

1. Physiological/bodily needs.

2. Safety needs.
3. Love/belonging needs.
4. Self-esteem.
5. Self-actualization (the desire to be "all that you can be").

The theory argues that the most fundamental level starts with the physiological need for food, water and shelter. This is followed by security and social needs. Maslow believed that the higher level needs, such as self-esteem and self-fulfillment, could only be met after the lower level needs had been satisfied. Maslow's hierarchic theory is often represented as a pyramid, with the lower levels representing the more fundamental needs, and the upper levels representing the growth/being needs, and ultimately the need for self-actualization. According to the theory, the higher needs in the hierarchy become evident only after all the needs that are lower down in the pyramid are met.

Level 1: Physiology, Body

Physiological needs are biological needs and include the needs for oxygen, food, water, shelter, etc. They are the basis for the hierarchy and are the strongest needs because if a person were deprived of all needs, the physiological ones come first in the person's search for satisfaction.

Level 2: Security

According to Maslow, the need for security becomes evident only after a person's physiological needs are met. While most adults are not acutely aware of security needs until a crisis arises, it is important to understand this need and for managers to provide a safe workplace.

Level 3: Belonging, Social

Once the needs for safety are met, the need for a sense of belonging, one in which a give-and-take relationship is nurtured, becomes evident. Maslow states that people seek to overcome feelings of loneliness and alienation and managers must understand this to ensure employee involvement, production and motivation, etc.

Level 4: Self-Esteem

Once the first three classes of needs are met, the need for self-esteem can become dominant. Because this includes the esteem a person gets from others, managers who understand this can use this tool to help ensure employees and team members feel valued and respected, driving up self-esteem.

This will positively impact the employee and the employee's motivation levels, productivity, ability to work on a team and alone, etc. On the other hand, if these needs are not met, an employee may become frustrated, feel inferior and worthless and he or she may withdraw.

Level 5: Self-Actualization

The need for self-actualization develops only after all of the foregoing needs are satisfied. According to Maslow, self-actualization is a person's need to do that which he or she feels they are meant to do. As a manager, it is important to help employees or team members find this, otherwise the employee will become dissatisfied, restless, unproductive and may even look for satisfaction elsewhere.

b) Describe the different types of customers and the process of receiving Customer Feedback Mechanism. Also discuss how to react on Customer Complaints?

Customer satisfaction, a business term, is a measure of how products and services supplied by a company meet or surpass customer expectation.

In a competitive marketplace where businesses compete for customers, customer satisfaction is seen as a key differentiator and increasingly has become a key element of business strategy.

Customer Satisfaction

1. Understanding customer needs
2. Defining quality
3. Teboul Model - Penetration
4. Customer satisfaction is a process never ending

Types of Customers

Internal Customer: The customers inside the company are called internal customers.

External Customers: An external customer is the one who used the product or service or who purchase the products or service or who influences the sale of the product or service

Basic Requirements of Internal and External Customers

1. High level of quality - meeting all his needs
2. High degree of flexibility - product flexibility
3. High levels of service - maximum service
4. Low costs - value for money, customers pride is that he has bought for the lowest cost
5. Quick response - Less waiting period, demo, billing, packing, delivery
6. Little of no variability - minimum deviation from the target and expectation

FEEDBACK (INFORMATION COLLECTING TOOLS):

Feedback enables organization to

- Discover customer satisfaction
- Discover relative priorities of quality

- Compare performance with the competition
- Identify customer needs
- Determine opportunities for improvement
- Listening to the voice of the customer can be accomplished by numerous information collecting tools.

Sources of Feedback

1.Comment Card - card attached with the warranty to get the basic information. Asking reasons for the purchase of product or service.

2. **Questionnaire** - Most popular. Mostly close ended and few open questions. Time consuming.Analyze and interpret data.

3. **Focus Group** - Select few customer, call for a meeting and discuss and collect data from them.Also ask them what their expectation is. Incentive for participation is assured in advance so that the customer is comfortable and not forced to participate.

4. **Toll Free Numbers** - Free telephone customer can call for assistance, register complaints

5. **Customer Visit** - It is very effective as customer is put on top priority but at the same time consuming, costly and customer interest.

6. **Report Card** - giving a grading sheet to the customer regarding the organization. Very effective, customer is at pride that he could evaluate the product or service.

7. **Internet** - Online and email feedback. Though easy but not 100% reliable source and lot of misrepresentation and lags seriousness on the part of the consumer.

8. **Employee feedback** - Untapped source of effective information. Customer says what is happening employees say why it is happening. Reactive to proactive approach

9. **Mass Customization** - make instant changes to the requirement of the customer. Dress materials, computer, furniture etc.

Ways to react customer complaints:

- Investigate customers experiences by actively getting feed back, both positive and negative, and then acting on it promptly
- Develop procedures for complaint resolution that include empowering front – line personnel.
- Analyze complaints, but understand that complaints do not always fit into neat categories.

- Work to identify process and material variations and then eliminate the root cause. “More inspection” is not corrective action.
- When a survey response is received, a senior manager should contact the customer and strive to resolve the concern.

- Establish customer satisfaction measures and constantly monitor them. Communicate complaint information, as well as the results of all investigations and solutions, to all people in the organization.

- Provide a monthly complaint report to the quality council for their evaluation and, if needed, the assignment of process improvement teams.

- Identify customers. expectations beforehand rather than afterward through complaint analysis.

23. a) The current capacity in ampere of 5 random samples from each batch are recorded. There are 10 such batches. Construct X and R chart and comment. Sample Size n = 5, D3=0, D4= 2.11, A2 = 0.58

BATCH NO.	CURRENT CAPACITY (AMPERE)				
	X_1	X_2	X_3	X_4	X_5
1.	43	61	64	69	72
2.	46	54	67	71	79
3.	18	23	74	76	81
4.	37	49	56	67	70
5.	41	44	64	70	74
6.	21	24	23	45	51
7.	56	61	61	62	84
8.	25	38	40	46	51
9.	24	34	46	51	66
10.	33	38	40	49	58

Solution:

For X-Bar Chart

$A_2 = 0.58$, $D_3 = 0$, $D_4 = 2.11$, $R = 34.2$

$$UCL_{\bar{x}} = \bar{\bar{x}} + A_2\bar{R}$$
$$LCL_{\bar{x}} = \bar{\bar{x}} - A_2\bar{R}$$

$$CL_{\bar{x}} = \bar{\bar{x}}$$

BATCH NO.	CURRENT CAPACITY (AMPERE)					Mean X bar	Range R
	X_1	X_2	X_3	X_4	X_5		
1.	43	61	64	69	72	61.8	29
2.	46	54	67	71	79	63.4	33
3.	18	23	74	76	81	54.4	63
4.	37	49	56	67	70	55.8	33
5.	41	44	64	70	74	58.6	33
6.	21	24	23	45	51	32.8	30
7.	56	61	61	62	84	64.8	28
8.	25	38	40	46	51	40.0	26
9.	24	34	46	51	66	44.2	42
10.	33	38	40	49	58	43.6	25
						519.4	**342**

Avg. Of Average = **X double bar = 519.4 / 10 = 51.94**

Range : 342 / 10 = 34.2

$$UCL_{\bar{x}} = \bar{\bar{x}} + A_2\bar{R}$$
$$LCL_{\bar{x}} = \bar{\bar{x}} - A_2\bar{R}$$

UCL x = 51.94 + (0.58 x 34.2)

= 71.78

LCLx = 51.94 - (0.58 x 34.2)

= 32.104

$CL_{\bar{x}} = \bar{\bar{x}}$ = **51.94**

Inference: Since all the points corresponding to Mean values lie within lower and upper control limits value, the process is within the statistical control.

For R-Chart

$D_3 = 0$, $D_4 = 2.11$

$$UCL_R = D_4\bar{R}$$
$$LCL_R = D_3\bar{R}$$

UCL_R = 2.11 x 34.2 = 72.162

LCL_R = 0 x 34.2 = 0 CL = R bar = 34.2

INFERENCE for R chart:

Inference: Since all the points corresponding to Range R values lie within lower and upper control limits value, the process is within the statistical control.

b) State the New Seven Management Techniques and explain
i) Affinity Diagram ii)Process Decision Program Chart

The seven advanced tools of quality management or the 'New Seven' is a collection of tools put together by a set of Japanese quality professionals. Many of the tools were already known to managers in other disciplines, sometimes by names different from what we will see in this book. For instance, Arrow Diagram, was known to engineers and project managers by names like PERT (Programme Evaluation and Review Technique) or CMP (Critical Mean Path). Another tool in this set PDPC (Process Decision Programme Chart) has been used in operations research. The seven tools we will see are :

The new seven management tools for quality are:

1. Affinity Diagram Method
2. Relation Diagram method
3. Tree Diagram Method
4. Matrix Diagram Method
5. Matrix Data Analysis
6. PDPC
7. Arrow Diagram Method

These tools, unlike SPC tools are qualitative tools. Most of these tools do not involve the use of numerical data. As the names suggest they are diagrams and charts which arrange available information in a visual form that helps managers in making sound decisions. Like all management tools these are judgmental tools. Managers are often called upon to make decisions based on their judgement with help of incomplete information or on subjective issues. Such decisions require discussions among members of cross functional teams. Team work and techniques like brainstorming are very essential for best results with such tools.

i) Affinity Diagram

The purpose of an affinity diagram is to provide a visual representation of grouping of a large number of ideas or factors or requirements into logical sets of related items to help one organise action plans in a systematic manner.

Procedure

The steps in the procedure for preparing an affinity diagram are :
1. Decide the subject or the topic

2. Generate a large number of ideas through brainstorming

3. Decide the number of groups and their titles. Create a card for each group. Enter the title of the group at the top of the card.

4. Distribute all the ideas among the cards. If necessary, create new cards for additional groups.

5. Arrange the cards according to the relationship between the groups.

6. Give a name to the affinity diagram.

Applications

Its simplicity makes it easy to combine it with other tools and put it to a wide variety of applications. For instance, it can be combined with a cause-and-effect diagram or a relations diagram to identify and regroup causes for a problem or it can be combined with a tree diagram to categorise possible solutions. Thus it can assist in problem solving. It can be used to group customer requirements in a complex product and can help one to design a product with characteristics and features that would satisfy and delight customers. It can be used to categorise actions in an implementation plan leading to a rationalised distribution of responsibility. In fact the tool can be used to break up any complex problem or task into smaller more easily manageable bits.

ii) Process Decision Program Charts

A process decision program chart (PDPC) is a method for mapping out every conceivable event and contingency that can occur when moving from a problem statement to possible solutions. A PDPC takes each branch of a tree diagram, anticipates possible problems,
and provides countermeasures that will (1) prevent the deviation from occurring, or (2) be in place if the deviation does occur. Figure 6 shows one example for implementing a strategy to educate and train all employees to use a new computer system.

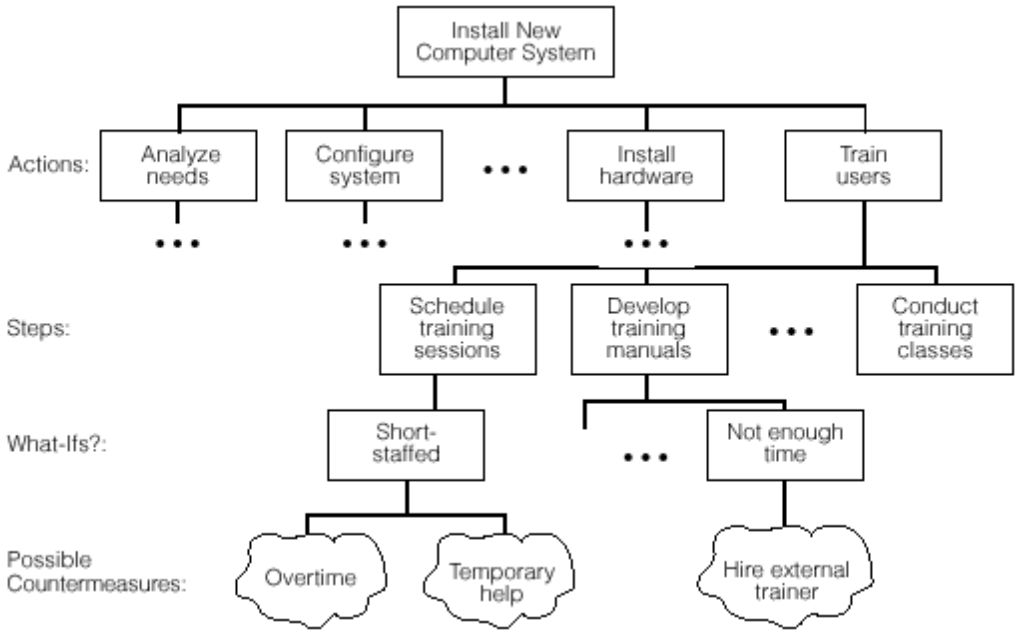


Figure - A Process Decision Program Chart

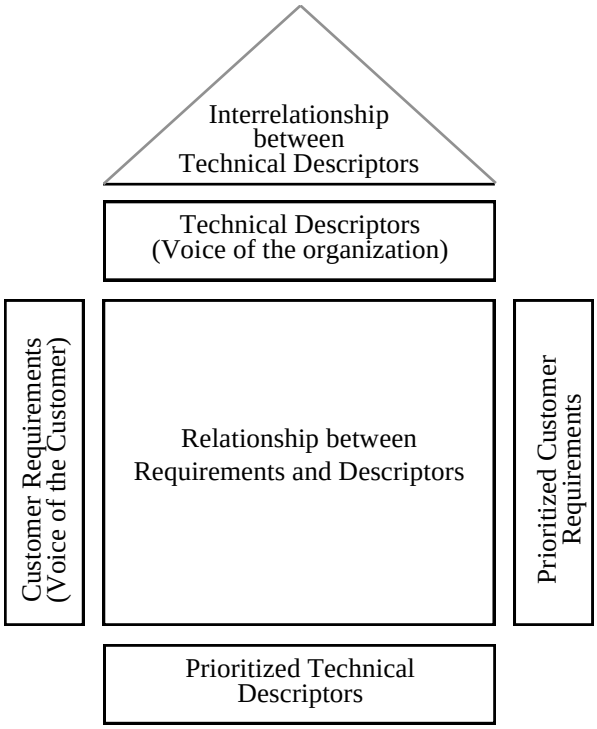
24. a) Explain Quality Function Deployment QFD with suitable example. What are its Advantages and limitations?

QFD – Quality Function Deployment is a systematic and organized approach to product design by taking customer needs and demands into consideration while designing a new products and services or while improving the existing products and services.

MEANING: The voice of the customer from the market research and various benchmarking is linked to the technicalities of the design and process of the product both new and existing.

DEFINITION: It is a kind of conceptual map that provides a means of inter-functional planning and communication.

The primary planning tool used in QFD is the House of Quality**.**



Step I - List customer requirement

WHAT - Decide Primary and secondary needs of the customer

Step II - List technical descriptions "HOW"
Again primary and secondary is decided
Primary - Material and Process
Subdividing materials and process required
Here current materials and process must be considered

Step III - Relation ship matrix between WHAT & HOW
The crucial stage relating WHAT & HOW
Interlinking both primary and secondary No scope for variation

Step IV - Interrelation matrix between HOW's

- The materials and manufacturing is analyzed
- Ratings are done
- Enables the decisions in the process
- Current process to be considered
- Technical knowledge is a must for the analyst

Step V - Our product with others

- Analyzing competitors products customer expectation
- Difficult to get data

- Mismatch in requirements is possible
- Helps in identifying customer trend

Step VI - Technical Competitive assessment

- Analyzing how the similar companies are handling To
- what they give importance.
- Impact on technical process to meet the customers request.

Step VII - Prioritize Technical Descriptors

- Degree of technical difficulty
- Most needed change is decided
- Target value
- Physical attributes to be considered

House of Quality Benefits

- Orderly way of obtaining information
- Shorter product development cycle
- Considerably reduced start up cost
- Fewer engineering changes
- Reduces design process
- Leads to teamwork
- Consensus decision
- Everything is preserved in writing

24. b) What is FMEA? What are its objectives? Discuss on Design FMEA

Failure modes and effects analysis (FMEA) is a step-by-step approach for identifying all possible failures in a design, a manufacturing or assembly process, or a product or service.

“Failure modes” means the ways, or modes, in which something might fail. Failures are any errors or defects, especially ones that affect the customer, and can be potential or actual.

“Effects analysis” refers to studying the consequences of those failures.

Failures are prioritized according to how serious their consequences are, how frequently they occur and how easily they can be detected. The purpose of the FMEA is to take actions to eliminate or reduce failures, starting with the highest-priority ones.

Failure modes and effects analysis also documents current knowledge and actions about the risks of failures, for use in continuous improvement. FMEA is used during design to prevent failures. Later it's used for control, before and during ongoing operation of the process. Ideally, FMEA begins during the earliest conceptual stages of design and continues throughout the life of the product or service.

Begun in the 1940s by the U.S. military, FMEA was further developed by the aerospace and automotive industries. Several industries maintain formal FMEA standards.

When to Use FMEA

- When a process, product or service is being designed or redesigned, after quality function deployment.
- When an existing process, product or service is being applied in a new way.
- Before developing control plans for a new or modified process.
- When improvement goals are planned for an existing process, product or service.
- When analyzing failures of an existing process, product or service.
- Periodically throughout the life of the process, product or service

FMEA Procedure

1. Assemble a cross-functional team of people with diverse knowledge about the process, product or service and customer needs. Functions often included are: design, manufacturing, quality, testing, reliability, maintenance, purchasing (and suppliers), sales, marketing (and customers) and customer service.
2. Identify the scope of the FMEA. Is it for concept, system, design, process or service? What are the boundaries? How detailed should we be? Use *flowcharts t*o identify the scope and to make sure every team member understands it in detail.

Design FMEA

Analysis is at the subsystem level (made up of various components) or component level.
The **Focus** is on product design-related deficiencies, with emphasis on

- improving the design
- ensuring product operation is safe and reliable during the useful life of the equipment.

- interfaces between adjacent components.

Design FMEA usually assumes the product will be manufactured according to specifications.

Benefits of FMEA:

- Improve product/process reliability and quality
- Increase customer satisfaction
- Early identification and elimination of potential product/process failure modes
- Prioritize product/process deficiencies

- Capture engineering/organization knowledge
- Document and track the actions taken to reduce risk
- Provide focus for improved testing and development
- Minimizes late changes and associated cost
- Act as catalyst for teamwork and idea exchange between functions.

25. a) Explain the steps to be followed in implementing Quality System ISO:9001:2000

ISO: The International Organisation for Standardisation is a world wide federation of national standards bodies from some 140 countries, non governmental organisation, established in 1947, to promote the development of standardisation and related activities.

The concept of quality underlying ISO 9000 is meeting customer's requirements. A product or service, therefore, has quality when it satisfies the user's needs, both stated and implied.

The **ISO- 9000 series** of Quality System Standards was brought in 1987 and **revised** in 1994 and subsequently in 2000 by International organisation for standardisation (ISO). Quality Management and Quality Assurance is responsible for formulation of ISO9000 Series of international standards. ISO means (delta) equal standardisation .The aim of ISO is " customer satisfaction by preventing non conformity at all stages from production through services".ISO standards are developed according to the principles of consensus, industry wise – global solutions to satisfy industries and customers world wide,voluntary

The ISO 9000 series of standards consists of two categories viz. Core standards and supplementary guidance standards-

1. ISO9000. Quality Management and Quality Assurance Standards- guidance for selection and use.
2. ISO9001. Quality Systems-Model for quality assurance in design, development, production, installation and servicing.
3. ISO9002. Quality Systems- model for quality assurance , installation and servicing
4. ISO9003 Quality systems- model for quality assurance in final inspection and test
5. ISO 9004-1: Quality Systems- Model for quality system elements

Basic Requirements of ISO 9001

1. Procedure to cover all processes in the business
2. Monitoring process to ensure effectiveness
3. Keeping adequate record
4. Defect verification and appropriate correction
5. Regular review of individual processes
6. Facilitating continual improvement

Benefits of ISO Registration

1. Increase in internal quality - reduction of scrap, rework etc
2. Production reliability - measure of breakdowns, time and shift management etc
3. External quality - acceptance by customers, less claims, return of goods
4. Time performance - marketing, delivery, production time etc

5. Cost of poor quality - scraps and rework

Implementation of QMS

The following steps are required in order to implement ISO 9000 Quality Management System. The steps to be followed to get ISO 9000 certification are:

1. Top management commitment - flow of action starts from the top
2. Appointment of management representative - qualified, trained, eager, participative
3. Awareness - to all employees in the organisation
4. Implementation team - constitute a council from all departments
5. Training - when new things are implemented then training is must
6. Time schedule - process time, change time, implementation, parallel process
7. Select element owners: Select owners for each of the system elements
8. Review present system - how the new is different and better from current
9. Write documents - step by step process
10. Install new system - implementation, change and acceptance take time
11. Internal audit - inspection, check and review
12. Management review - report to the top management
13. Reassessment: This step is optional.
14. Registration - apply for registration
15. Award of ISO 9000 certificate

b) What are the requirements of ISO-14000 series of standards? Explain them briefly.

The International Organisation for standards (ISO) has designed a comprehensive set of standards for environmental management (ISO 14000 series of standards) in 1992. ISO 14000 standards aims a world-wide focus on environment and encouraging a cleaner, safer and healthier world for all. This standard allows the organizations to achieve the internally accepted criteria with respect to environment.

Requirements of ISO 14000:

ISO 14000 is divided into six clauses and has a total of eighteen requirements. The major elements of an EMS standards are:

1.General Requirements: The organization should establish and maintain an environmental management system that includes policy, planning, implementation, checking and corrective action and management review.

2.Environmental policy

Initially, the organization's top management should have commitment and define the policy on Environmental Management System(EMS) which is used for the direction of implementing and improving its EMS.

-Identification of legislative and regulatory requirements.

- Identification of environmental aspects of its activities, products, or services

- Identification of existing activities with suppliers

- Identification of existing management policies and procedures

- Evaluation of past performance with regard to the above.

3.Planning

In order to achieve environmental policy, at least the organization should :

- Identify the environmental aspects of its activities and specify those which have significant impacts on the environment.
- Identify legal and other requirements to which the organization involved.
- Establish objectives and targets of its activities having impacts to environment.
- Establish environmental programs for achieving its objectives and targets.

4. Implementation : In order to achieve environmental planning, at least, the organization should :

- Define roles, responsibilities and authorities for facilitating EMS effectively.

- Communicate to the staffs at each level for the importance of conformance to the environmental policy; provide appropriate training to personnel performing the tasks to gain their knowledge and competence.

- Establish and control documentation relating to EMS.

- Control operations and activities to meet the specified objectives and targets.

- Identify potential accidents and emergency situations for preventing and mitigating the environmental impacts that may be associated with them and periodically test such procedures where practicable.

5.Checking and corrective action

To ensure that the organization is performing in accordance with the stated EMS programmes, at least, the organization should:

- Monitor and measure its operations and activities against the organization's plans.
- Identify non-conformance and take action to mitigate any impact caused.
- Record the on-going activities of the EMS.
- Conduct periodic EMS audits.

6. Management review

- The organization's top management should review and continually improve its EMS, with the objective of improving its overall environmental performance.

Questions	opt1	opt2	opt3	opt4	opt5	opt6	Answer		
Quality is defined as	Fitness for the purpose	Manufacture for the purpose	Market for the purpose	All of the given options			Fitness for the purpose		
The Dimensions of Quality	Conformance	Reliability,	Durability	All of the given options			All of the given options		
Poor quality in a design project is likely to directly affect _____ costs.	manufacturing / building	advertising	overhead	A and C			A and C		
Quality function deployment refer to	Making design decision Concurrently	Improving quality with in the function	Improving Quality	All of the given options			All of the given options		
The quality cost is classified into	Prevention costs	Appraisal costs	Internal cost	All of the given options			All of the given options		
Features, service, response and aesthetics are	Quality costs	Dimensions of quality	Quality functions	quality planning statement			Dimensions of quality		
Quality is often influenced by all of the following except:	fabrication processes and methods	supervision	inspection	cost of materials			Ensuring quality of outgoing product		
The primary components of quality management are quality _____.	inspections, certifications	B)philosophy, assurance	form, fit, and function	reliability, maintainability			philosophy, assurance		
The quality cost is classified into	Prevention costs	Appraisal costs	Internal cost	All of the given options			To identify analyze and solve problems		
Initiator of Quality function deployment	Robert Camp	Dr.D.Clausing	D.T.Kearns	Dr.Mizuno			All of the given options		
The cost of the quality model is referred to the PAF, It refers to	Protection, Appraisal, Failure	Prevention, Appraisal, Failure	production, Appraisal, Failure	All of the given options			prevention		
Quality statement consists of	Vision statement	mission statement	Quality policy	All of the given options			To provide an guidance for the all effectiveness of the quality system		
In quality management COQ refers to	Conformance of quality	Cost of quality	Change of quality	Committee of quality			Cost of quality		
Benchmarking helps in setting goals and objectives by considering factors from	External Environment	Internal Environment	Both a & b	Only b			External Environment		
Quality Loss Function concept was introduced by	Dr.Taguchi	Dr.D.Clausing	D.T.Kearns	Dr.Mizuno			All of the given options		
The rating will give an idea about ability of a company to implement the particular	Technical Descriptor	Tools	Both a & b	Both a & b			Technical Descriptor		
Absolute weight of each technical descriptor can be found out by	Product of the corresponding row values	Product of the corresponding row values	Product of the corresponding diagonal values	Both a & b			Product of the corresponding row values		
Quality planning is an essential activity that decides its success	In the market place	In the design place	In the production place	All of the given options			All of the given options		
Modifying existing standards to better match the need of a project or environment is	Definition	Standard for a standard	tailoring	Customization			tailoring		
Factors that contribute to societal loss is	Product not meeting the customer requirement	Does not function in the ideal way it has to do	Produces harmful side effects	All of the given options			All of the given options		
Which of the following is a loss function	Step Function	Quadratic loss function	Both a&b	Only a			Both a&b		
Objective of carrying out TPM is	Maintaining the equipment in condition till the life of the equipment	Improving the capacity of the equipment	Continuous Improvement	All of the given options			All of the given options		
Steps involved in TPM Process	Assessment of the present performance	Training the employee	Training the managers	Both a & b			Both a & b		
The successful implementation of TPM depend on how good the	Employees is getting data from Top level management	Top level management is in getting data from employees	Both a & b	Only a			Top level management is in getting data from employees		
The first step in achieving TPM is to give more decision making power to the	Employees in production & Maintenance Department	Maintenance Department	Production	Management			Employees in production & Maintenance Department		
In TPM Training starts with	Employee	Managers	Top level Management	Both a&b			Top level Management		
Factors contribute to Production Loss are	Down Time Losses	Losses due to slow speed	Loss due to poor quality	All of the given options			All of the given options		
The factor come under Planned down time loss	Start up loss	Due to lack of raw material	Loss due to change in speed	Due to poor quality			Due to poor quality		
Quality assurance is a function responsible for	Controlling quality	managing quality	Inspections	removal of defects			managing quality		
Total Product Maintenance has 5 goals which of the following is not a goal of TPM	Maximize equipment effectiveness.	Develop a system of productive maintenance for the life of the equipment,	Maximize The product Quality	Actively involve all employees			Maximize The product Quality		
Cost of dissatisfaction, repair cost and warranty cost are elements of cost in the	Taguchi Loss Function	Pareto chart	ISO 9000 Quality	Process Chart			Taguchi Loss Function		
The practice of ceasing mass inspections and ending awards based on price is credited	Edward Deming	Philip Crosby	Juran	Pareto			Edward Deming		
Juran's definition for quality is	Quality is conformance to requirements	quality is fitness for use	Quality is in its essence, a way of managing the organization	Quality is correcting and preventing loss			quality is fitness for use		
The concept of making a giant leap forward followed by a period of maturity is	Innovation	Continuous improvement	Just in time	Paradigm			Innovation		
Which of the following is not considered a cost of nonconformance to quality?	Scrap	Rework	Expediting	Process control			Process control		
Percentage of sales is estimated to be the cost of non-quality	3-5%	12-20%	30-40%	6-8%			12-20%		
A series of consecutive points on the same side of the average is called	Run	Trend	Outliers	Cycle			Run		
The symbols to represent the degree of relationship between the customer requirement and technical descriptors is	A solid circle	A single circle	A triangle	All of the given options			All of the given options		
80% of the problems are found in 20% of the work is a concept of	Edward Deming	Philip Crosby	Juran	Pareto			Pareto		
A tool that analyzes the Input to a process to identify the causes of errors is called:	Cause and effect diagram	Scatter diagram	Ishikawa diagram	a and c			a and c		
When a product or service completely meets a customer's requirements	quality is achieved	cost of quality is high	cost of quality is low	the customer pays the minimum price			quality is achieved		
The _____ of a product or service mostly affects its reliability and maintenance characteristics.	design	concept	fabrication	performance			design		
Primary responsibility for quality management in the project rests with the:	project engineer	purchasing agent	quality manager	project manager			project manager		
The Standards by foundation for TQM program by concentrating on	Implementing Quality Controls	Documenting various process and procedures	Ensuring that the appropriate quality emphasis is established and followed	All of the given options			All of the given options		
Unless evidence indicates otherwise, a process is assured to be	in control	out of control	working at full capacity	working at less than full capacity			in control		
Which is not a environmental auditing standards	14031	14010	14011	14021			14031		
The highest point of Maslow's hierarchy of needs is	physiological satisfaction	attainment of survival	need for association	esteem			esteem		
The goals of TPM	Maintaining and improving equipment capacity	Maintaining equipment for life	Using support from all areas of the operation	All of the given options			All of the given options		
Who is ultimately responsible for quality management on the project?	Project engineer	Project manager	Quality manager	Team member			Project manager		
The loss areas	Slow-downs	Process nonconformities	Scrap	All of the given options			All of the given options		

Questions	opt1	opt2	opt3	opt4	opt5	opt6	Answer
PDSA means	plan, do check, act	plan, do study, act	Plan, desire, study, act	Plan, discipline, study, act			plan, do study, act
The Japanese term SEIKETSU means	Tidiness	orderliness	Standardization	discipline			Standardization
The term _____ means cleanliness	SEIRI	SEITON	SEISO	SEIKETSU			SEISO
Basic concepts of TQM involves	Top to bottom organizational support	Utilization of entire work force	Continuous improvements	All of the given options			All of the given options
The purpose of TQM is to provide	Quality products to customer's	High cost of product to customer	Less service to customers	All of the given options			Quality products to customer's
Kanban is a method for	Transport components from plant to customer	Signal replenishment of inventory	Decreasing change over time	All of the given options			Signal replenishment of inventory
In kanban system IPK stands for	Initial power kanban	Initial power kanban	In process kanban	All of the given options			In process kanban
In kanban system, the replenishment time is	Transport container to replenishment point	Refill the container	Time required retrieving the signal container	All of the given options			All of the given options
Kaizen means	Price change	Re design	scrap	continuous improvement			continuous improvement
5-S aims for	Design changes	Technology up gradation	Housekeeping	All of the given options			Housekeeping
5-S Seiso stands for	systemize	systemize	Sort	Standardize			systemize
Poka-Yoke means	quality	service	Mistake	Production			Mistake
Juran's Trilogy means	Quality Planning, Q.Control, Q.Improvement	Q.planning, Q.goals, Q.Target	Q.delivery, Q.Service, Q.Supplier	Q.Planning, Q.improvement,Q.measurement			Quality Planning, Q.Control, Q.Improvement
Herberg's two factor theory is also called as	Positive motivation theory	negative motivation theory	motivation-hygiene theory	All of the given options			motivation-hygiene theory
According to Juran which of the following is crucial	Quality improvement	quality control	Quality planning	Quality costs			Quality planning
`A heuristic is best described as a:	control tool	scheduling method	planning tool	rule of thumb			rule of thumb
In the matrix management organization, which of the following is true?	The project manager is responsible for employee skills improvement.	The functional manager is responsible for employee skills improvement.	The project manager is responsible for the employee.s annual appraisal.	The employee is responsible for his or her own skills improvement.			The project manager is responsible for employee skills improvement.
The project management process groups are:	Initiating, planning, expediting, and control.	Plan, organize, develop, and control.	Plan, do, observe, commit.	Initiating, planning, executing, controlling			Initiating, planning, executing, controlling
Documents to be prepared by most organization in quality system	Quality policy Manual	Quality system Procedures	Work Instructions	All of the given options			All of the given options
5-S Seition stands for	systemize	systemize	Sort	Standardize			Sort
Which is not a stage of an audit	Audit Planning	Audit Performance	Audit Reporting	Audit Check			Audit Check
Institute leadership and institute training comes under	TQM pillars	quality statements	Deming's statement	leadership			Deming's statement
Which of the following is a barrier to team progress?	Lack of planning	appreciation	Motivation	responsibility			Lack of planning
_____ is the process of retaining the existing customers.	Customer retention	Customer plan	Customer satisfaction	Customer perception			Customer retention
5-S Seiri stands for	systemize	systemize	Sort	Standardize			Sort
Who are the most important people in the business_____?	Suppliers	employees	Customers	partners			Customers
_____ is a method of analysis of data by grouping it in different ways	Scatter diagram	control chart	Stratification	histogram			Stratification
Three measures of central tendency generally used are_____	mean, range, mode	mean, median, mode	Range, mean deviation, standard deviation	range, mode, standard deviation			mean, median, mode
_____ can be defined as a collection of related observations.	Information	statistics	Analysis	data			data
_____ is defined as that value of the variable which occurs most frequently.	Mean	median	Mode	range			Mode
Customer needs, customer positioning, gap analysis, closing the gap are called	Strategic planning	quality statements	TQM elements	TQM pillars			Strategic planning
Rework, redesign, modification costs are	Prevention costs	appraisal cost	Internal failure cost	external failure cost			Internal failure cost
Which of the following is not coming under MASLOW'S five basic needs?	Safety	social	Feature	esteem			Feature
_____ is a guide for everyone in the organization as to how they should provide products and services to the customers.	Vision statement	mission statement	Quality policy statement	Juran statement			Quality policy statement
Which of the following conflict resolution techniques will generate the MOST lasting solution?	Forcing	Smoothing	Compromise	Problem solving			Problem solving
_____ is the process of continuous improvements in small increments that make the process more efficient, effective, controllable and adequate.	Deming	Juran	Crosby	Kaizen			Kaizen
5-S Seiketsu stands for	systemize	systemize	Sort	Standardize			systemize
A supplier rating system is also referred as a _____	Plan card system	Score card system	Process card system	card system			Score card system
_____ proposed seven tools of quality	Dr.Juran	Mike Robinson	Prof.Ishikawa	Philip crosby			Prof.Ishikawa
……..helps in determining the impact of why failure on other items in the product or process	FMEA	SPC	FMEA & SPC	FEMA			FMEA
First Party Audit is performed…… by trained person	Internally	Internally	both internally and externally	All of the given options			Internally
Decomposing the major deliverables into smaller, more manageable components to provide better control is called:	Scope planning.	Scope definition.	Scope verification.	All of the given options			Scope definition.
Basic needs include	Food, clothing, sleep	shelter, warmth, self-defense	Friendship, love, respect	status, recognition, responsibility			Food, clothing, sleep
Any numbering system that is used to monitor project costs by category such as labor, supplies, or materials, for example, is called:	Chart of accounts.	Work breakdown structure.	Universal accounting standard.	Standard accounting practices.			Chart of accounts.

_____ is a short declaration of what an organization aspires to be tomorrow.	Vision statement	mission statement	Quality policy statement	Juran statement			Vision statement
Analysis techniques for quality costs are _____	Trend analysis	pareto analysis	Both trend analysis and pareto analysis	systematic analysis			Both trend analysis and pareto analysis
The term _____ means that discipline	SEIRI	SEITON	SHITSUKE	SEIKETSU			SHITSUKE
_____ is the ease of keeping the product operable.	Maintainability	availability	Reliability	service			Maintainability
Workarounds are determined during which risk management process?	Risk identification	Quantitative risk analysis	Risk response planning	Risk monitoring and control			Risk monitoring and control

Questions	opt1	opt2	opt3	opt4	opt5	opt6	Answer
Six sigma allows for only_____ defects per million opportunities	3.4	3.5	4.6	4.4			3.4
The seven basic tools are used to facilitate successful accomplishment of_____ objectives	Production improvement	Protection improvement	Quality improvement	for more profit			Quality improvement
A graph that displays data taken over time and the variations of this data is known as_____	Histogram	check sheet	Scatter diagram	pareto diagram			Scatter diagram
The new seven management tools includes	Affinity diagram method	Relation diagram method	Tree diagram method	All of the given options			All of the given options
Six sigma is a disciplined approach for improving	better products with best quality	Low pricing	Production	All of the given options			better products with best quality
The fundamental stages of six sigma for improvement in process performance is	DMAIC	FMEA	TPM	SPC			DMAIC
DMAIC –D stands for	. Design	Define	Depreciation	Description			Define
Six sigma concept is given by	Taguchi	Bob Kelvin	Deming	Juran			Bob Kelvin
The control chart for variable is	X’ and R charts	P chart	C chart	P and C chart			X’ and R charts
The control chart for attributes is	X’ and R charts	P chart	C chart	P and C chart			P and C chart
The control chart for fraction defectives is	X’ and R charts	P chart	C chart	P and C chart			P chart
A temporary endeavor undertaken to create a new product or service is called a	New product development.	Project.	Program.	Enterprise.			Project.
_____ is used to show relations between individual items in two sets of factors	tree diagram	matrix diagram	Arrow diagram	Line diagram			matrix diagram
_____ refers to those quality characteristics that confirm to specifications or do not conform to specifications.	Attribute	variable	Six sigma	5 S			Attribute
_____ can be defined as processed data.	Information	statistics	Analysis	data			Information
DMAIC –C stands for	Control	classify	Consume	Custom			Control
……..should be carried out as soon as failure is identified	Creative action	sudden reaction	Corrective action	All of the given options			Corrective action
Which phase of the project is likely to have the greatest amount of its funding s	Initiating	Executing	Planning	Closeout			Executing
Which of the following represents the estimated value of the work actually accomplished?	Earned value (EV)	Planned value (PV)	Actual cost (AC'	Cost variance (CV)			Earned value (EV)
The dimensions of quality are	Performance	Features	Conformance	All of the given options			All of the given options
The dimensions of quality includes	Reliability	Durability	Service	All of the given options			All of the given options
Quality planning is an essential activity that decides its success	In the market place	In the design place	In the production place	All of the given options			In the market place
The essential steps in quality planning will include	Establishing quality goals	Discover customer needs	Develop product and process features	All of the given options			All of the given options
The cost of the quality model is referred to the PAF, It refers to	Protection, Appraisal, Failure	Prevention, Appraisal, Failure	production, Appraisal, Failure	All of the given options			Prevention, Appraisal, Failure
DMAIC –A stands for	. Approval	Appraisal	Alter	Analyse			Analyse
The total quality management Philosophy that involves	Everyone in the organization	To improve quality	To achieve customer satisfaction	All of the given options			All of the given options
The definition of quality “Fitness for the Purpose” – defined by	J.M. Juran	H.F. Dodge	H.C. Romig	W.E.deming			J.M. Juran
SPC concepts and importance of quality were developed by	W. Edward deming	J.M. Juran	H.F. Dodge	H.C. Romig			W. Edward deming
Barriers to TQM implementation includes	Lack of commitment	Lack of motivation	Lack of empowerment	All of the given options			All of the given options
The control chart theory with control limits assignable and chance cause of variation Developed by	Deming	Juran	Shewhart	Genichi Taguchi			Shewhart
The statistical process control and the importance quality taught by	Deming	Juran	Shewhart	Genichi Taguchi			Genichi Taguchi
_____ is best known for the development of the cause and effect diageam and quality circle concept	Juran	Ishikawa	Deming	Shewhart			Shewhart
“ Do it right first time” is less expensive then the cost of detecting and correcting nonconformities is given by	Juran	Ishikawa	Crosby	Taguchi			Crosby
_____ Developed loss function concept that combines cost, target and variation into one metric.	Juran	Ishikawa	Crosby	Taguchi			Taguchi
Statistical process control is an effective system for	controlling the process parameter	Comparing it with standards	Taking correcting action if there is any deviation	All of the given options			All of the given options
Pareto charts arranged in a descending order of data’s and cumulative percentage of attribute data to	Help the user to identity quickly	Indicates frequency occurring type of defects	To choose the starting point for problem solving	All of the given options			All of the given options
DMAIC –I stands for	Inspection	Improve	Initiate	Install			Improve
Cause and effect diagram is very much useful for	Analyzing the causes	identifying a problem	Inspecting a product/Process	Process			Analyzing the causes
Check sheet is very much useful and help in presenting the large amount of dat	In a pictorial manner	Can easily understand the problem	Show the trends at a glance	All of the given options			In a pictorial manner
Graphs are very much useful and help in presenting the large amount of data	In a pictorial manner	Can easily understand the problem	Show the trends at a glance	All of the given options			All of the given options
Histograms are useful in studying the	Variation in process and its capabilities	Volume of rejection	Protection rate of a shift	All of the given options			Variation in process and its capabilities
Control charts are useful in	Monitoring process performance over time	Status of process to correct or reset the process	Out of control is immediately noticed	All of the given options			All of the given options
The factors that contributes for variations includes	Tool wear	machine vibration	Poor quality raw materials	All of the given options			All of the given options
The important parameter for distribution of central tendency is	Arithmetic mean – Average value	median – The middle value	Mode – The most frequently occurring value	All of the given options			All of the given options
DMAIC –M stands for	Maintenance	Machine	Measure	Mention			Measure
The important measure of dispersion is	Range	Standard deviation	Variance	All of the given options			All of the given options
Defect refers to	A quality characteristic not meeting the specification	In a product, if anything is broken	Both a and b	Only b			A quality characteristic not meeting the specification
The Affinity diagram method can contribute to	clarity the problem	clarity the state that exist	Coordinate ideas	All of the given options			All of the given options
The relation diagram method is used to	search for a cause of a defect	clarity the structure of a problem	Deploying a mean to achieve an objective	All of the given options			All of the given options
The tree diagram method is used to	To find feasible measures for a problem	Clarity the problem	Coordinate ideas	All of the given options			To find feasible measures for a problem

Questions	opt1	opt2	opt3	opt4	opt5	opt6	Answer
Benchmarking is time as well as cost effective because	using Existing technique	Inventing new ways of achieving the end result	Companies are actually imitating what their competitors have done	Both a & b			Companies are actually imitating what their competitors have done
Benchmarking helps a company to achieve	Business and Competitive objectives	Supplier Selection	Relationship Development	Competitors Performance			Business and Competitive objectives
Which of the following does not form a part of a workbench?	Standards	Quality attribute	Quality control	Procedures			Quality attribute
QFD starts with	Market Research	Product Research	Process Research	Product Quality			Market Research
QFD is systematic and structured planning tool which is used to convert the voice of the customers in to appropriate	Quality Product	Technical Requirement	Both a & b	only a			Technical Requirement
QFD objective is achieved by companies by incorporating the voice of the customers in to	Process planning process	Product Planning Process	Parts development Process	Production Development Process			Product Planning Process
The first and foremost planning tool used in QFD is the	Quality In House	House of quality	quality houses	relationship matrix			House of quality
The term " benchmarking" means	Comparing with past data from your organization	Comparing with the results of a market survey	Comparing with the results of a customer survey	Best product manufacturing company			Best product manufacturing company
FMEA attempts to find out the potential	Process Related Failure	Product related Failure	Both a&b	Only a			Product related Failure
The Taguchi method include three major concept these includes all of the following except	Quality Loss Function	Quality Robustness	Target oriented quality	Employee Involvement			Employee Involvement
Genichi Taguchi introduces for quality is	Team work of employee	Inspection method	Assign value and tolerance for product and process	Both a & b			Assign value and tolerance for product and process
The type of FMEA is	design FMEA	process FEMA	both A and B	Only b			both A and B
FMEA is a …………….. technique	Analytical	graphical	both a&b	Only b			Analytical
Taguchi Quality loss function is based on a	Linear Equation	Binomial Distribution	Quadratic Equation	Negative Exponential Distribution			Negative Exponential Distribution
QFD helps in removing the	Product Error	Process Error	Design Error	Quality Error			Design Error
FMEA Means	Failure Mode and Effect Analysis	Failure Model and Effect Analysis	Failure Method and Effect Analysis	Failure Method and Element Analysis			Failure Mode and Effect Analysis
Benchmarking is a …………………of searching out	Performance Measure	Continuous Improvement Process	Measure of Dispersions	Process Capability			Continuous Improvement Process
QFD is the method to ensure quality by	incorporating the customer requirements	incorporating the Design changes	incorporating the process changes	All of the given options			incorporating the customer requirements
The house of quality is a matrix for QFD and the component of the house is	Quality customer service	Product characteristics	Technical evaluation	All of the given options			All of the given options
The voice of customer for product development will includes	Product planning	Part development	Process planning	All of the given options			All of the given options
QFD benefits includes	Customer Driver	Promotes team work	Provide documentation	All of the given options			All of the given options
Taguchi's method have the approach of	. System design	Parameter design	Tolerance design	All of the given options			All of the given options
In techniques of quality function the FMEA refers to	Failure method effect analysis	Failure mode effect analysis	Failure mode ensure analysis	All of the given options			Failure mode effect analysis
The design FEMA identifies	Expected failure modes	Known failure modes	Known and expected failure modes	All of the given options			Known and expected failure modes
The process of FEMA identifies	Expected failure modes	Known failure modes	Potential failure modes	All of the given options			Potential failure modes
The stages in analyzing FEMA is	specify the possibility of failure	quantity of risk of failure	Correcting high risk cause	All of the given options			All of the given options
Appraisal cost includes	Education and Training	Inspection and Product Auditing	Rework and Scrap	Warranty and Customer complaint			Inspection and Product Auditing
Internal Failure cost includes	Education and Training	Inspection and Product Auditing	Rework and Scrap	Warranty and Customer complaint			Rework and Scrap
External Failure cost includes	Education and Training	Inspection and Product Auditing	Rework and Scrap	Warranty and Customer complaint			Warranty and Customer complaint
Hidden quality cost includes	Customer returns	. Process down time	Premium fright cost	All of the given options			All of the given options
The techniques for analyzing quality cost	Trend analysis	pareto analysis	Bar and pie chart Analysis	All of the given options			All of the given options
The objectives of quality cost evolution is	Opportunities for cost reduction	Potential improvements	Reduce customer dissatisfaction	All of the given options			All of the given options
Quality Loss Function concept was introduced by	Dr.Taguchi	Dr.D.Clausing	D.T.Kearns	Dr.Mizuno			Dr.Taguchi
Initiator of Quality function deployment	Robert Camp	Dr.D.Clausing	D.T.Kearns	Dr.Mizuno			Dr.Mizuno
Basic types of control charts used are_______	Variable chart	attribute chart	Both variable and attribute	number chart			Both variable and attribute
The Matrix diagram method is used to	obtain clues for problem	Clarity the problem	Coordinate ideas	All of the given options			obtain clues for problem
The Process decision program chart is used to	Establish measures to avoid undesirable situation	Clarity the problem	Coordinate ideas	All of the given options			Establish measures to avoid undesirable situation
The Arrow diagram uses the principle of	PERT method	CPM method	Both a and b	Only b			Both a and b
The PERT refers to	Project evaluation review technique	Project evaluation revision technique	Both a and b	Only b			Project evaluation review technique
The CPM refers to	Central path method	Check path method	Critical path method	All of the given options			Critical path method
JIT aims for	quality	Zero inventory	Zero accident	process planning			Zero inventory
JIT system belongs to	Push system	Pull system	Both push and pull	Only b			Pull system
The main objective of JIT is to	Reduce lead time	Increase profit	To satisfy customer	All of the given options			Reduce lead time
Optimize process and procedures by continuously pursuing waste reduction is the goal of	TMQ	TPM	TQM	JIT			JIT
The infrastructure needed to achieve conformity to product includes	Building and workplace	Process equipments	Supporting services	All of the given options			All of the given options
The slogan " whatever you do, Document it. Whatever you document Do it", refers to	QMS	TQM	ISO	TPM			ISO
Which of the following is a hygiene factor?	Achievement	recognition	Working condition	advancement &growth			Working condition
__________ is usually one paragraph or less in length, is easy to understand, and describes the function of the organization.	Vision statement	mission statement	Quality policy statement	Juran statement			mission statement
_____________ is a measure of product's life having both economic and technical dimensions.	Conformance	Reliability	Durability	Service			Durability
The organization depends on ___________	Suppliers	employees	Partners	Customers			Customers

Question Opt 1 Opt 2 Opt 3 Opt 4 Opt 5 Opt 6 Answer Question Opt 1 Opt 2 Opt 3 Opt 4 Opt 5 Opt 6 Answer Question Opt 1 Opt 2 Opt 3 Opt 4 Opt 5 Opt 6 Answer Question Opt 1 Opt 2 Opt 3 Opt 4 Opt 5 Opt 6 Answer Question Opt 1 Opt 2 Opt 3 Opt 4 Opt 5 Opt 6 Answer Question Opt 1 Opt 2 Opt 3 Opt 4 Opt 5 Opt 6 Answer Question Opt 1 Opt 2 Opt 3 Opt 4 Opt 5 Opt 6 Answer Question Opt 1 Opt 2 Opt 3

Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer

Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3

Opt 4	Opt 5	Opt 6	Answer

Questions	opt1	opt2	opt3	opt4	opt5	opt6	Answer
Inherent in ISO 9000 standard is concept of a ………………contractual relationship	Two-party	third party	both a&b	Only b			Two-party
ISO 9000 provides a foundation and complementary approach to quality by focusing on ………………documentation and maintenance of appropriate records	Process	cycle	circular	regular			Process
ISO registration brings	Better Documentation	Greater Quality	Positive Cultural Change	All of the given options			All of the given options
Document and data control standards require a system of	Document Revision	Document Distribution	Removal of obsolete documents	All of the given options			All of the given options
Which one is not a ISO series	ISO 9000:2000	ISO 9001:2000	ISO 9002:2000	ISO 9004:2000			ISO 9002:2000
In implementation ISO 9000-2000 it also includes	Training and time schedule	Review the present systems	Preparation of the document	All of the given options			All of the given options
The ISO/TS 16949 will be applicable to	Machine tool suppliers	Farm machinery suppliers	Automotive suppliers	Both a & b			Automotive suppliers
The series of ISO 14000 are designed to	Environmental Management system	Environmental Auditing	Environmental Performance Evaluation	All of the given options			All of the given options
ISO 9000 is not a …………….registration	Product	bi-product	Product & byproduct	Process			Product
The requirements of ISO 14001	General requirements	Environmental policy	Planning	All of the given options			All of the given options
ISO 9000 audit system include first party audit and …………………audit	First party audit	second party audit	Third Party Audit	All of the given options			Third Party Audit
Second party audit which are performed by a customer at a…………… location	Partners	suppliers	Customers	suppliers &Customers			suppliers
TL 9000 quality system came out for	Telecommunication Industry	Oil industry	Sugar industry	foundry			Telecommunication Industry
ISO is only responsible for …………&……………. International Standards	Creating and publishing	creating but not publishing	Publishing	All of the given options			Creating and publishing
benefits of ISO 14000	Global	Organizational	Conserving input materials and energy	All of the given options			All of the given options
ISO stands for	International standards organisation	International organisation for standardisation	Indian organisation for standards	Internation organisation for standards			International standards organisation
International organisation for standardisation was formed in the year	1970	1946	1990	1975			1946
ISO was founded in the year 1946 in	Japan	USA	Geneva, Switzarland	India			Geneva, Switzarland
BIS refers to	Bureau of International standards	British information system	Bureau of Indian standards	Bureau of Institute standards			Bureau of Indian standards
The structure of ISO 9000-2000 consists of	. ISO 9000-2000	ISO 9001-2000	ISO 9004-2000	All of the given options			All of the given options
9001-2000 Describes the	QMS-Fundamentals and vocabulary	QMS- Requirements	QMS-Guidance for performance improvement	All of the given options			QMS- Requirements
9004-2000 Describes the	QMS-Fundamentals and vocabulary	QMS- Requirements	QMS-Guidance for performance improvement	All of the given options			QMS-Guidance for performance improvement
the requirements of ISO 14001	General requirements	Environmental policy	Planning	All of the given options			All of the given options
The objective of ISO 9000-2000 are	Ability to provide a product to meet customer requirement	To address customer satisfaction through effective application of a system	To address customer satisfaction through effective application	Both A and B			Both A and B
There are _______ numbers of function types.	2	3	4	5			4
Baselines measure the _____________________ change.	situation prior to	Expectation of benefits of	Effects of	Desirability of			situation prior to
Elements of ISO 9000-2000 includes	Scope, terms and definitions	Quality management system	Management responsibility	All of the given options			All of the given options
The ISO 14000 family is primarily concerned with	Marketing management	Quality management	Environmental management	Industrial			Environmental management
The term ___________ means tidiness.	SEIRI	SEITON	SEISO	SEIKETSU			SEIRI
A product service should be suitable for the need and satisfies the	Employee beyond his expectations	Employer beyond his expectations	Customer beyond his expectations	All of the given options			Customer beyond his expectations
Prevention cost includes	Education and Training	Inspection and Product Auditing	Rework and Scrap	Warranty and Customer complaint			Education and Training
Cause and effect diagram is also known as	pareto diagram	scatter diagram	Fishbone diagram	Arrow diagram			Fishbone diagram
A fundamental attribute of TQM is	Drawing control charts	Having team meetings	Top management's direct involvement	Meeting ISO 9000 audit			Top management's direct involvement
Team orientation means	ISO 9000 orientation meetings	Cooperation with government regulators	Working collectively toward a common goal	Workers getting daily briefing			Working collectively toward a common goal
The American model for TQM is	The Baldrige Award criteria	Use of quality circles in the shop	ISO 9000	ISO 14000			The Baldrige Award criteria
The Baldrige Award is	A ISO 9000 requirement	An indication of SPC being used	Indication of no competition	Indication that TQM programs are effective			Indication that TQM programs are effective
Process Flow Charts help in finding out	Process steps and their relationship	Cost of quality	A clause in ISO 9000	Customer complaints			Process steps and their relationship
ISO 9002 requires	Constantly holding meetings with customers	Frequent vendor visits	Getting production and inspection	Getting final inspection methods shipshape			Getting production and inspection
some other quality systems	QS-9000	TE-9000	AS9000	All of the given options			All of the given options
Benefits of teamwork are	Improved integration	improved communication	improved integration and communication	Improved work			improved integration and communication
Suppliers are treated as______	Owners	Employees	Partners	Leaders			Partners
The probability of a product's failing within a specified period of time is __________	Conformance	Reliability	Durability	Service			Reliability
…………..covers terms and definition that are common to both organization and product areas.	ISO 14001	ISO 14050	ISO 14011	ISO 14004			ISO 14050
External Failure cost includes	Education and Training	Inspection and Product Auditing	Rework and Scrap	Warranty and Customer complaint			Warranty and Customer complaint
Strategic planning includes	Customer needs	customer positioning	Predict the future	All of the given options			All of the given options
ISO 14004 entitled EMS for	General Guidelines	Specification	Audit Procedures	Auditor Criteria			General Guidelines
ISO 9000 standards basically have …………….requirements	Two	three	four	five			three
Benefits of ISO 14000 can be categorized as	Global benefits	Organizational benefits	Economical benefits	All of the given options			All of the given options
In ISO 14000-Global benefits includes	Facilitate trade and remove trade barriers	Improve environmental performance	Both A and B	only A			Both A and B
In ISO 14000- organizational benefits includes	Improving industrial relation	Meeting industrial relations	Both A and B	only B			Both A and B

Question Opt 1 Opt 2 Opt 3 Opt 4 Opt 5 Opt 6 Answer Question Opt 1 Opt 2 Opt 3 Opt 4 Opt 5 Opt 6 Answer Question Opt 1 Opt 2 Opt 3 Opt 4 Opt 5 Opt 6 Answer Question Opt 1 Opt 2 Opt 3 Opt 4 Opt 5 Opt 6 Answer Question Opt 1 Opt 2 Opt 3 Opt 4 Opt 5 Opt 6 Answer Question Opt 1 Opt 2 Opt 3 Opt 4 Opt 5 Opt 6 Answer Question Opt 1 Opt 2 Opt 3 Opt 4

Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question

Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4

Opt 5	Opt 6	Answer	Question	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Answer