UNIT I-INTRODUCTION

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

PART-A

1	**What are the elements of TQM?** There are eight key elements of TQM such as: Ethics, Integrity, Trust, Training, Teamwork, Leadership, Recognition, Communication.
2	**Define Total Quality Management.** 1.The art of managing the total organization to achieve excellence in all spheres of activity.(Besterfield). 2.The integration of all functions and processes within an organization in order to achieve the continuous improvement of the quality of goods and services. (Omachonu).
3	**Mention the basic features of TQM.** 1.Management commitment, 2.Focus on customer (both external and internal) 3.Employee involvement, empowerment 4.Continuous improvement 5.Treating suppliers as partners, and 6.Establish performance measures for processes.
4	**What are the benefits of TQM?** Improved quality, higher productivity, employee participation, teamwork, working relationships, customer satisfaction, employee satisfaction, communication, profitability, market share, and stock price performance
5	**Define Quality.** Quality =Performance/Expectations 1. Predictable degree of uniformity and dependability at low cost and suited to the market -Deming 2. Fitness for use-Juran 3. Conformance to requirements - Crosby
6	**What are the various quality statements?** The quality statements include the vision statement, mission statement, and quality policy statement.
7	**What is a Vision statement?** A short declaration of what an organization aspires to be in the future. It is an ideal state that an organization continually strives to achieve. It is timeless, inspirational, and becomes deeply shared within the organization
8	**What is a Mission statement?** The mission statement answers the following questions: who we are, who are our customers, what we do, and how we do it. The mission provides the guide map, milestones for achieving the vision.
9	**What is Deming Cycle?** P-D-S-A (Plan-Do-Study-Act) cycle of continuous improvement.
10	**What are the major dimensions of product quality?** Performance, features, usability, conformance to standards/specifications, reliability, durability, maintainability, etc
11	**What are the three levels of quality in the Kano model of customer satisfaction?** 1. Basic quality 2. Performance quality

<table>
<tr><td></td><td>3. Excitement quality.
The products corresponding to these three quality levels were termed as ‘Dissatisfies’, ‘Satisfiers’ and ‘Delighters/Exciters’ respectively in the Kano model.</td></tr>
<tr><td>12</td><td>What is importance of customer retention?
It costs a company six times more to sell a product to a new customer than it does to sell to an existing one. Loyal customers generate more revenue, and are also cheaper to maintain. Customer loyalty facilitates cross-selling/up-selling of a company’s other products/services, and also acts as an effective barrier to the entry of competition.</td></tr>
<tr><td>13</td><td>Distinguish between ‘internal customer’ and ‘external customer’.
<table>
<tr><th>External customer</th><th>Internal customer</th></tr>
<tr><td>An external customer exists outside the organization and can be defined in many ways – user, buyer, influencer. He generally falls into one of three categories: current, prospective, or lost customer.</td><td>Every function within the organization – engineering, production, order processing, etc. – has an internal customer. Every person in a process is considered a customer of the preceding operation. For example, Manufacturing is a customer for Purchasing, and Dispatching is a customer for Packaging.</td></tr>
</table></td></tr>
<tr><td>14</td><td>What do you mean by service quality?
Service quality is nothing but, Service duration, timeliness, completeness, consistency, convenience, accuracy, courtesy, etc</td></tr>
<tr><td>15</td><td>What is meant by ‘Cost of quality’?
Quality costs are defined as costs associated with non-achievement of product/service quality. In simple terms, quality cost is the cost of poor products/services. All costs associated with poor quality and its correction are integrated into one system to enhance the quality management function.</td></tr>
<tr><td>16</td><td>What are the four categories of quality costs? .(Nov/Dec2016)
1.Prevention costs
2.Appraisal costs
3.Internal failure costs
4.External failure costs.</td></tr>
<tr><td>17</td><td>What are internal failure costs?
These are costs required to identify, repair, replace, or dispose off defective products/services prior to delivery to the customer.</td></tr>
<tr><td>18</td><td>Mention the names of some major contributors to the quality movement.
1.Edwards Deming
2.Joseph M. Juran
3.Philip Crosby
4.Feigenbaum
5.Ishikawa
6.Taguchi
7. Shingo
8. Walter Shewhart , etc.</td></tr>
<tr><td>19</td><td>Mention the four pillars of TQM?
Customer satisfaction, continuous improvement, Quality leadership and systems approach</td></tr>
<tr><td>20</td><td>What is the importance of customer focus for an organization?
Customers are the most important asset of an organization. An organization’s success depends on how many customers it has, how much they buy, how often they buy, and how long they are retained (loyalty).</td></tr>
</table>

21	**What is Deming's "System of Profound Knowledge"?** Deming summarized his philosophy in what he called "A System of Profound Knowledge". It comprised of 4 parts: 1.Appreciation for a system 2.Some knowledge of the theory of variation 3.Theory of knowledge, and 4. Psychology. Deming recognized the synergy among these diverse subjects and developed them into a theory of management.
22	**What are some major obstacles to TQM implementation?** Lack of management commitment, Inability to change organizational culture, Improper planning, Lack of continuous training and education, Paying inadequate attention to internal and external customers, Inadequate use of empowerment and teamwork, Lack of employee involvement, Emphasis on short-term results, etc.
23	**What is customer satisfaction?** Customer satisfaction is a measure of the degree to which a product or service meets the customer's expectations.
24	**How can quality be quantified?(May/June 2016)** Quality can be expressed as P/E where P denotes performance and E denotes expectation.
25	**What do you mean by service quality? (May/June 2016)** Quality of service offered is judged based on the following dimensions: Reliability, Responsiveness, Assurance, Empathy, Tangibles etc
26	**What are the different ways to create customer oriented culture in an industry? (Nov/Dec2016)** 1.Base their values on customer feedback 2.Involve their employees in the development of values 3.Link these values to their brand 4. Encourage their employees to align their behaviours to the values. 5. Reward their employees for living the brand.
27	What are the four absolutes of quality defined by Crosby? ***(April/May 2017)*** (1) Quality is defined as conformance to requirements, not goodness (2) The system for achieving quality is prevention, not appraisal (3) The performance standard is zero defects, not that's close enough and (4) The measure of quality is the price of non-conformance, not indexes.
28	Define quality policy statements. ***(April/May 2017)*** Quality policy statement is a document developed by management to express the directive of the top management with respect to quality
	PART-B
1	**Discuss in detail the dimensions of Quality in the context of Service/Product Quality.(Nov/Dec2016)** ❖ **Performance** ❖ **Features** ❖ **Conformance** ❖ **----------** ❖ **Reliability** ❖ **Durability** ❖ **Service** ❖ **----------** ❖ **Response- of Dealer/ Mfgr. to Customer** ❖ **Aesthetics – of product** ❖ **Reputation- of Mfgr./Dealer**

	All these nine dimensions can be clearly explained with the example of LCD projector. ▪ Performance - Primary product characteristics, such as the brightness of the picture ▪ Features - Secondary characteristics, added features, such as remote control. ▪ Conformance - Meeting specifications or industry standards, workmanship. ▪ Reliability – Consistency of performance over time, average time for the unit to fail. ▪ Durability – Useful life, includes repair ▪ Service – Resolution of problems and complaints, ease of repair. ▪ Response – Human-to-human interface, such as the courtesy of the dealer. ▪ Aesthetics – Sensory characteristics, such as exterior finish ▪ Reputation – Past performance and other intangibles, such as being ranked first. ➢ These dimensions are somewhat independent therefore a product can be excellent in one dimension and average or poor in another. ➢ Therefore quality products can be determined by using a few of the dimensions of the quality. ➢ Marketing has the responsibility of identifying the relative importance of each dimension of quality. ➢ These dimensions are then translated into the requirements for the development of a new product or the improvement of an existing one.
2	**Explain the Juran's view of TQM./ Discuss Juran's principle of Quality improvement. (June, 2013)/ Explain in detail about Juran Trilogy. (April, 2014) (May/June 2016)** **Juran's Triology** 1. Quality Planning 2. Quality Control 3. Quality Improvement **Quality Planning:** The planning component begins with external customers. Once the quality goals are established, marketing determines the external customers and all organizational personnel (managers, members of multifunctional teams or work groups) determine the internal customer. Once the customers are determined, their needs are discovered. Customer needs has to be stated in their own words, however real needs may differ from stated needs. Internal customers may not wish to voice real needs out of fear of the consequences. The customer needs which are stated in their view point should be translated to requirements that are understandable to the organization and its suppliers. The next step is to develop the product/service features that respond to customer needs, meet the needs of organization and its suppliers. The fourth step is to develop the processes able to produce the product or service features. Transferring plans to operations is the final step of the planning process. **Quality Control:** Control is used by operating forces to help meet the product, process and service requirements. **Steps:** Determine items/subjects to be controlled and their units of measure. Set goals for control and determine what sensors need to be put in place to measure the product, process or service. Measure actual performance. Compare actual performance to goals. Act on the difference. **Quality Improvement:** Aim is to attain the levels of performance that are significantly higher than current levels. Process improvements begin with the establishment of quality council. Two duties of quality council Identify the improvement projects Establish the project teams with a project owner. Quality council needs to provide the teams with resources to determine the causes, create

solutions and establish controls to hold the gains.

- In the figure juran provides a distinction between sporadic waste and chronic waste
- Sporadic waste can be identified and corrected through quality control.

Chronic waste requires an improvement process.

- As solution is found through the improvement process, lessons learned are brought back to the quality planning process, so that new goals may be established for organization.

THREE UNIVERSAL PROCESSES OF THE JURAN TRILOGY ®

Improvement Strategies:

- Repair
- Refinement
- Renovation
- Reinvention

Repair:

- This strategy is simple; if anything is broken it must be fixed so that it functions as designed.
- If a customer receives a damaged product, a quick fix is required.
- The second level is to identify and eliminate the root causes of the problem and effects a permanent solution.
- Repair strategy does not make the process better than the original design.

Refinement:

- Improvements to processes, products and services are accomplished on an incremental basis.
- Refinement improves efficiency and effectiveness.
- The change may be so gradual that there is no appearance of change.
- The primary benefit of gradual change is that it produces little resistance from employees.

Renovation:

- This strategy results in major or breakthrough improvements.
- Innovation and technological advancements are key factors in this approach.
- Eg: Rechargeable batteries

Reinvention:

- Renovation is the most demanding improvement strategy.
- It is preceded by the feeling that the current approach will never satisfy customer requirements.

A new product, service, process or activity is developed using teams based on a complete understanding of the customer requirements and expectations.

Types of Problems:

- Compliance
- Unstructured
- Efficiency
- Process design
- Product design

3	Explain the Dimensions of product quality. (***Nov/Dec2016)***
	Dimensions of quality

	Quality has different dimensions. These dimensions are somewhat independent and therefore, a product can be excellent in one dimension and average or poor in another. Dimensions of product quality: 1. Performance: primary product characteristics, e.g. picture brightness in TV. 2. Features: secondary characteristics, added features, e.g. remote control, picture-in-picture. 3. Usability: ease of use with minimum training. 4. Conformance: meeting specifications, industry standards,. (E.g. ISI specs., emission norms). 5. Reliability: consistency of performance over a specified time period under specified conditions. 6. Durability: extent of useful life, sturdiness. 7. Maintainability/Serviceability: ease of attending to maintenance, repairs. 8. Efficiency: ratio of output to input. E.g. mileage, braking distance, processing time. 9. Aesthetics: sensory characteristics, e.g. appearance, exterior finish, texture, color, shape, etc. 10. Reputation: subjective assessment based of past performance, brand image, industry ranking. 11. Safety: in items like pressure cookers, electrical items, toys, cranes, etc.
4	**Explain the evolution of TQM.** **1920s** Some of the first seeds of quality management were planted as the principles of scientific management swept through U.S. industry. Businesses clearly separated the processes of planning and carrying out the plan, and union opposition arose as workers were deprived of a voice in the conditions and functions of their work. The Hawthorne experiments in the late 1920s showed how worker productivity could be impacted by participation. **1930s** Walter Shewhart developed the methods for statistical analysis and control of quality. **1950s** W. Edwards Deming taught methods for statistical analysis and control of quality to Japanese engineers and executives. Joseph M. Juran taught the concepts of controlling quality and managerial breakthrough. Armand V. Feigenbaum's book Total Quality Control, a forerunner for the present understanding of TQM, was published. Philip B. Crosby's promotion of zero defects paved the way for quality improvement in many companies. **1968** The Japanese named their approach to total quality companywide quality control. Kaoru Ishikawa's synthesis of the philosophy contributed to Japan's ascendancy as a quality leader. **Today** TQM is the name for the philosophy of a broad and systemic approach to managing organizational quality. Quality standards such as the ISO 9000 series and quality award programs such as the Deming Prize and the Malcolm Baldrige National Quality Award specify principles and processes that comprise TQM.
5	**Write basic concepts of TQM?** 1. A committed and involved management to provide long-term top-to-bottom organizational support 2. An unwavering focus on the customer, both internally and externally. 3. Effective involvement and utilization of the entire work force 4. Continuous improvement of the business and production process. 5. Treating suppliers as partners 6. Establishing performance measure for the process

6 **Explain Deming Principles for quality achievement. (April, 2014) .(Nov/Dec2016)**

Deming has given 14 points

Create and Publish the Aims and Purposes of the Organization

- Management must create and publish the aims and purposes of the organization to investors, customers, suppliers, employees, the community and a quality philosophy.
- Organization should develop a long term view of business and set goals according to that.
- In order to achieve these goals resources must be allocated to research, training and continuing education.
- Innovation must be promoted to ensure that the product or service does not become obsolete.

Learn the New Philosophy:

- Top management and everyone in the organization must learn the new philosophy.
- Organization must concentrate on defect prevention rather than defect detection.
- Organizations must give importance to never ending improvement and refuse to accept nonconformance.
- Customer satisfaction is the number one priority because dissatisfied customers will not continue to purchase nonconforming products or services.
- Everyone in the organization including the union must be involved in the quality journey and change his or her attitude about quality.

Understand the Purpose of Inspection:

- Management must understand that the purpose of inspection is to improve the process and reduce its cost.
- For the most part of the organization, mass inspection is costly and unreliable.
- Where ever the inspection is required it should be applied and replaced by never ending improvement process.

It should be clearly understood that mass inspection is for managing failure and defect prevention is for managing success.

Stop Awarding Business Based on Price Alone:

- The organization must stop awarding business based on the low bid because price has no meaning without quality.
- The goal is to have single suppliers for each item and to develop a long term relationship of trust and loyalty, thereby providing improved products and services.
- They must follow the materials throughout the life cycle in order to examine how customer expectations are affected and provide feedback to the supplier regarding the quality.

Improve Constantly and Forever the System:

- Management must take more responsibility in actively finding and correcting problems, so that quality and productivity are continually and permanently improved and costs are reduced.
- The focus is on preventing problems before they happen.
- Responsibilities are assigned to the teams to remove the causes of the problems and continually improve the process.

Institute Training:

- Each employee must be oriented to the organizations philosophy of never ending improvements.
- Management must allocate resources to train their employees to perform their jobs in the better manner.

Teach and Institute Leadership:

- Improving Supervision in the organization is the management's responsibility.
- Management must appoint supervisors with training, so that the new philosophy can be implemented.
- Supervisors should create a positive and supportive work environment instead of focusing on negative and fault finding atmosphere.
- All communication must be clear from top management to supervisors to operators.

Drive out Fear, Create trust and Create a Climate for Innovation:

- Management must encourage open, effective communication and team work.
- Fear is caused because of lack of job security, possible physical harm, performance appraisals, and ignorance of organization goals, poor supervision and not knowing the job.

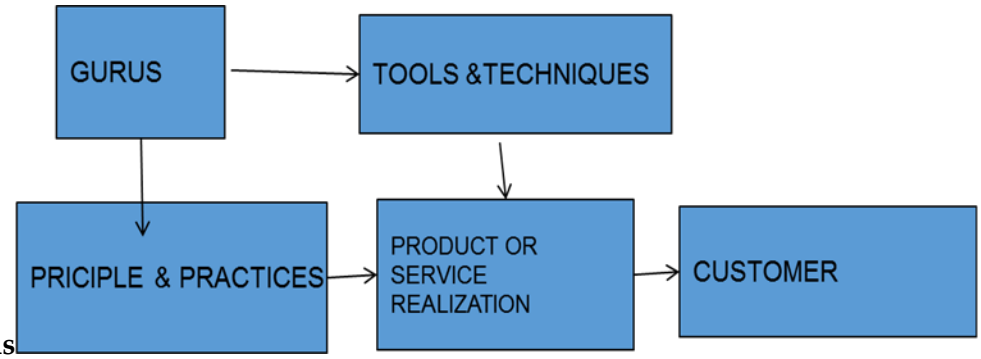
	Driving out fear will lead to success, for this management must concentrate on workers with adequate training, good supervision, and proper tools to do the job as well removing physical dangers. When people are treated with dignity fear can be eliminated and they will work for the general well being of the organization. **Optimize the efforts of teams, groups and staff areas:** Management must optimize the efforts of teams, groups and staff areas to achieve the aims and purposes of the organization. Internally the barriers exist among levels of management, among departments, within departments and among shifts. Externally it exists between the organization and its customers and suppliers. The barriers exist because of poor communication, ignorance of organization mission and it can be overcome by multifunctional team. **Eliminate Exhortations for the Workforce:** Exhortations that ask for increased productivity without providing specific improvement methods can handicap an organization. They do not produce better product or service because the workers are limited by the system. Improvements in the process cannot be made unless the tools and methods are available. **a. Eliminate Numerical Quotas for the Workforce:** Quotas and work standards focus on quantity rather than quality. Instead of quotas, management must concentrate on methods of improvement. They encourage poor workmanship in order to meet their quotas. **b. Eliminate Management by Objective:** Instead of management by objective, management must learn the capabilities of the processes and how to improve them. Management by numerical goal is an attempt to manage without knowledge of what to do. **Remove Barriers that Rob People of Pride of Workmanship:** Loss of pride in workmanship exists throughout the organization because Workers do not know how to relate to organizations mission They are being blamed for system problems. Poor designs lead to the production of junk. Inadequate training is provided. Punitive supervision exists. Inadequate or ineffective equipment is provided for performing the required work. **Encourage Education and Self Improvement for Everyone:** When an organization needs is people who are improving with education, a long term commitment to continuously train and educate people must be made by management. **Take Action to Accomplish the Transformation:** Management has to accept the primary responsibility for the never ending improvement of the process. A cultural change is required from the previous “business as usual” attitude. Management must be committed, involved and accessible if the organization is to succeed in implementing the new philosophy.
7	**Explain the contributions of Crossby to TQM.** Philip Crosby, author of ***Quality is Free.*** Crosby emphasized meeting customer requirements by focusing on prevention rather than correction. **His "Absolutes" are:** (1) Quality is defined as conformance to requirements, not *goodness;* (2) The system for achieving quality is prevention, not appraisal; (3) The performance standard is zero defects, not *that's close enough;* and (4) The measure of quality is the price of non-conformance, not indexes. **14 Principles** 1. Management commitment, that is, top level management must be convinced and committed and communicated to the entire company. 2. Quality improvement team composed of department heads to oversee improvements. 3. Quality measurement is established for every activity.

4. Cost of quality is estimated to identify areas of improvement.
5. Quality awareness is raised among all employees.
6. Corrective action is taken.
7. Zero defects are planned for.
8. Supervisor training in quality implementation.
9. Zero defects day is scheduled.
10. Goal setting for individuals.
11. Error causes are removed by having employees informed management of problems.
12. Recognition is given, but it is non-financial, to those who meet quality goals.
13. Quality councils meet regularly.
14. Do it all over again (i.e., repeat steps one through thirteen).

8 **Explain the TQM framework.**

TQM framework gives the overall structure of the organization.

It consist of



Gurus

- Shewhart
- Deming
- Juran
- Figenbaum
- Ishikawa
- Crosby
- Taguchi

Tools and Techniques

- Benchmarking
- Information Technology
- Quality Management Systems
- Environmental Management Systems
- Quality Function Deployment
- Quality by Design
- Failure Mode and Effect Analysis
- Product and Service Liability
- Total Productive Maintenance
- Management tools
- Statistical Process Control
- Experimental Design
- Taguchi's Quality Engineering

People and Relationships

- Leadership

Customer Satisfaction

- Employee Involvement
- Supplier Partnership

Approach

- Continuous Process Improvement

Measure

- Performance measures

9	**State and explain the barriers to TQM implementation in an organization. / What are the barriers while implementing TQM? Also explain evolution of Quality.(May/June 2016)** **Lack of Management Commitment** - There must be a substantial management commitment of management time and organizational resources. - The purpose must be clearly and continuously communicated to all personnel - Management must consistently apply the principles of TQM **Inability to change organizational Culture** **- Basic Concepts** People change when they want to and to meet their own needs. Never expect anyone to engage in behavior that serves the organizational values unless adequate reason (why) has been given. For change to be accepted, people must be moved from a state of fear to trust. - Speeches, Slogans, Campaigns are effective only for a short period of time. - Organization that spend more time on change, only have chances of success. **Improper Planning** - All constituents of the organization must be involved in the development of the implementation plan and any modification that occurs as the plan evolves. - The most important thing is two way communications of ideas by all personnel during the development of the plan and its implementation. - Customer satisfaction should be the goal rather than the financial or sales goals. **Lack of continuous training and education** - Training and education is an ongoing process for everyone in the organization. - Training and education are most effective when senior management conducts the training on the principles of TQM. **Incompatible Organizational Structure and Isolated Individuals and Departments.** - Differences between departments and individuals can create implementation problems. - The use of multifunctional team will help to break down long-standing barriers. Restructuring the organization to meet organization needs is important. - Individuals who do not embrace the new philosophy can be required to leave the organization. **Ineffective Measurement Techniques and Lack of Access to Data and Results.** - Key characteristics of the organization should be measured so that the effective decisions can be made. - Access to data and quick retrieval is necessary for effective processes. **Paying Inadequate Attention to Internal and External Customers** - Organizations need to understand the changing needs and expectations of their customers. - Effective feedback mechanisms that provide data for decision making are necessary for this understanding. - When an organization fails to empower individuals and teams, it cannot hold them responsible for producing results. **Inadequate Use of Empowerment and Teamwork** - Teams need to have the proper training and at least in the beginning a facilitator. - Individuals should be empowered to make decisions that affect the efficiency of their process or the satisfaction of their customers. **Failure to Continually Improve** - A lack of continuous improvement of the processes, product or service will even leave the leader of the pack in the dust.
10	**Write short notes on :i) customer perception of quality and ii) Customer complaints** **CUSTOMER PERCEPTION OF QUALITY.** In an organization there is no acceptable quality level because the customer's needs, values and expectations are constantly changing and becoming more demanding. *An American Society for Quality (ASQ) survey reveals the following end-user perception of quality* 1.Performance 2.Features

3.Service
4. Warranty
5. Price
6. Reputation.

CUSTOMER COMPLAINTS

- Unlike the customer's feedback the customer complaints are reactive, and they are important in gaining data on customer perceptions.
- A dissatisfied customer can easily become a lost customer because of their frustrations. This customer dissatisfaction becomes a measure for organizational process improvement measures.
- Every single complaint should be accepted, analyzed, and acted upon to again win over customer's confidence. Since more than 50% of the dissatisfied customers will buy again if they are complaint has been heard and resolved.
- By adopting a positive approach the complaints can be seen as an opportunity to obtain information and provide a positive service to the customer.

Ways to get customer feedback or complaint

1. 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 this card is to get simple information such as name, address, age, occupation and what influenced the customer's decision to buy the product.
- Generally people respond only if something very good or very bad has happened.

2. Customer Questionnaire

- A customer questionnaire is a popular tool for obtaining opinion 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 questionnaire the customer is asked to furnish answers relating to the quality of product and services.

3. Focus Groups

- Customer focus groups are a popular way to get feedback, but they too can be very expensive**.**
- These groups are very effective for gathering information on customer expectations and requirements.
- 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.

4. Toll-Free Telephone Numbers

- Toll-free telephone numbers are an effective technique for receiving complaint feedback.
- Organizations can respond faster and more cheaply to the complaint.

5. Customer Visits

- **Visit**

6.Report card-quarterly basis
7.Internet and computer
8. Employee feedback

Handling the customer complaints

1. Investigate customer's experiences by actively receiving the customer feedback and then acting promptly.
2. Develop procedures for complaint resolution that include empowering front-line employee.
3. Analyze complaints; try to put them in a category for speedy response.
4. Work to identify process and material variations and then eliminate the root cause.'more inspection' is not a corrective action.
5. After receiving the response, a senior manager should contact the customer and strive top resolve the concern
6. Establish customer satisfaction measures and constantly monitor them
7. Communicate complaint information, as well as the results of all inquiries and solutions, to all people in the organization.

	8. Provide a monthly complaint report to the quality council for their evaluation and if needed, the assignment of process improvement teams. 9. Identify customer's expectations in advance rather than afterward through complaint analysis.
11	**Explain the role of Senior Management in TQM Implementation(Nov/Dec2016)** In all business organization, senior management is the responsible personnel to establish the organization strategies. It is the senior management who has to create the strategic atmosphere and organizational environment for Total Quality Management (TQM) to thrive. They have to ensure that resources are provided and directed towards building a quality management system. The CEO has to get personally involved and has to spread the knowledge and clear the air about any misconceptions regarding TQM to his senior managers. He also must exhibit patience and believe that TQM is a long term strategy and must not expect immediate financial benefits. The CEO must also ensure an accurate reflection of the needs and expectations of customers to enable the organization to make quality improvements, through performance measures like failure statistics, customer surveys and complaints, lost sales, customer returns, unaccepted tenders, etc. Senior managers must create an atmosphere which promotes teamwork, co-operation and participation from all members in healthy decision making, and effective two way communication. An important responsibility of the top management is to assign the roles and responsibilities to responsible personnel who will assist them in the deployment of total quality management. The responsibility of ensuring that all employees know why the organization is heading towards TQM, and what potential benefits will result in their area or function or process, lies with the senior managers. Senior managers must also realize and accept that there is no single or best way to implement TQM. They need to learn from experience, attend courses and seminars, study about the best practices as far as TQM is concerned, and consult other organizations in the same industry who have introduced TQM successfully. Senior managers must be ready to understand and apply the statistical methods in problem solving and decision making like SPC to make sure that the improvement effort is based on fact and data and not opinion or myth. Their responsibilities can be summed up as: □ Disseminating the idea of total quality □ Setting standards like zero failure □ Monitoring quality performance (quality costs) □ Introducing a quality system based on 'prevention' rather than detection □ Introducing process control methods like Statistical Process Control (SPC)
12	**Illustrate the various steps in the customer satisfaction process(Nov/Dec2016)** Step 1 – Understanding Customer Expectations • Step 2- Promises to Customers • Step 3 – Execution • Step 4 - Ongoing Dialog with a Customer • Step 5 - Customer Satisfaction Surveys
13	Elaborate the fourteen steps involved in Crosby's total quality approach. **(April/May 2017)** 14 Principles: 1. Management commitment, that is, top level management must be convinced and committed

	and communicated to the entire company. 2. Quality improvement team composed of department heads to oversee improvements. 3. Quality measurement is established for every activity. 4. Cost of quality is estimated to identify areas of improvement. 5. Quality awareness is raised among all employees. 6. Corrective action is taken. 7. Zero defects are planned for. 8. Supervisor training in quality implementation. 9. Zero defects day is scheduled. 10. Goal setting for individuals. 11. Error causes are removed by having employees informed management of problems. 12. Recognition is given, but it is non-financial, to those who meet quality goals. 13. Quality councils meet regularly. 14. Do it all over again (i.e., repeat steps one through thirteen).
14(i)	Describe the various dimensions of quality with respect to the following: Quality in products and quality in services. ***(April/May 2017)*** Performance: Performance refers to a product's primary operating characteristics. This dimension of quality involves measurable attributes; brands can usually be ranked objectively on individual aspects of performance. Features: Features are additional characteristics that enhance the appeal of the product or service to the user. Reliability: Reliability is the likelihood that a product will not fail within a specific time period. This is a key element for users who need the product to work without fail. Conformance: Conformance is the precision with which the product or service meets the specified standards. Durability: Durability measures the length of a product's life. When the product can be repaired, estimating durability is more complicated. The item will be used until it is no longer economical to operate it. This happens when the repair rate and the associated costs increase significantly. Serviceability: Serviceability is the speed with which the product can be put into service when it breaks down, as well as the competence and the behavior of the serviceperson. Aesthetics: Aesthetics is the subjective dimension indicating the kind of response a user has to a product. It represents the individual's personal preference. Perceived Quality: Perceived Quality is the quality attributed to a good or service based on indirect measures.
14 (ii)	Explain the common customer feedback collection tools***(April/May 2017)*** 1. Comment Card 2. Customer Questionnaire 3. Focus Groups 4. Toll-Free Telephone Numbers 5. Customer Visits 6.Report card-quarterly basis 7.Internet and computer 8. Employee feedback
UNIT II-TQM PRINCIPLES **Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal- Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.**	
PART-A	
1	**List out any four benefits of employee involvement? (May/June 2016)** Conformance, acceptance, contribution, commitment, cooperation, concentration, accountability, ownership.

2	**What is the 'Juran Trilogy' ('Quality Trilogy')?** The **Juran Trilogy (Quality Trilogy)** consists of three inter-related processes – quality planning, quality control, and quality improvement – for managing quality.
3	**What are the roles assigned to people in Quality Circles?** The QC organization has a four-tier structure consisting of *Members, Leaders, Facilitators, and Steering Committee* **.**
4	**Mention the major contribution of Feigenbaum to quality.** He was the originator of the concept of Total Quality Control (TQC). His concept of Total Quality Control was used as the foundation by the Japanese for their practice called 'Company-Wide Quality Control' [CWQC] which began in the 1960s and later evolved into TQM.
5	**What are Quality Circles (QC)?** QC is a small team of people (around 8 to 10) coming from the same work area/department who voluntarily meet on a regular basis (about an hour every week) to identify, investigate, analyze and solve work-related problems. QC can be viewed from three angles: 1.As a form of participative management 2.As a HRD technique, and 3.As a problem-solving technique
6	**What are Crosby's Four Absolutes of Quality Management?** 1. Quality means conformance to requirements, not elegance. 2. Quality is achieved by prevention, not appraisal. 3. The performance standard is zero defects, not acceptable quality levels. Quality is free. 4. Quality is measured by the price of non-conformance, not indexes
7	**What are the steps in implementing Quality Circle projects?** 1. Select the problem 2. Study the problem 3.Plan the improvement 4.Carry out the improvement 5.Check the results 6.Form conclusions 7.Present to management 8.Obtain approval and 9.Implement on regular basis.
8	**Mention some tools used by Quality Circles for solving problems.** Data collection, Brainstorming, Check sheets, Pareto Analysis, Cause & Effect diagrams, Control charts, Presentation techniques, etc. are used by quality circles in solving problems.
9	**Mention some major objectives of Quality Circle projects.** 1. Improve quality and productivity. 2. Cost reduction. 3. Effective utilization of resources. 4. Avoid unnecessary errors, defects. 5. Solve work-related problems that interfere with production, etc.
10	**What is 5 s? / What are the Japanese 5S principles?** The 5S's stand for five Japanese words: **Seiri** **Seiton** **Seiso** **Seiketsu** and **Shitsuke.**

	In English, they mean ***Sort, Arrange, Clean up, Systematize,*** and ***Discipline*** respectively.
11	**What does Seiri mean?** Separate out all unnecessary things and remove them, retaining only necessary things.
12	**What does Seiton mean?** Seiton means orderliness. It means setting everything in proper order so that they can be easily accessed for use and quickly put away in their proper locations after use.
13	**What does Seiso mean?** Keep machinery and work environment clean.
14	**What does Seiketsu mean?** Develop routine practices for orderly, systematic working.
15	**What does Shitsuke mean?** Impart systematic training and coaching to ensure discipline in 5S implementation
16	**Explain Kaizen . *(April/May 2017)*** Kaizen, which is a Japanese word that means gradual and orderly continuous improvement, is a philosophy that covers all business activities and everyone in an organization. In the kaizen philosophy, improvement in all areas of business – cost, meeting delivery schedules, employee safety and skill development, supplier relations, new product development, and productivity – serve to improve the quality of the firm. Thus, any activity directed toward improvement falls under the kaizen umbrella.
17	**Explain Supplier Rating.** A supplier rating system (often called a scorecard system) is usually based on quality, delivery, and service; however, some customers have added other categories, such as lead time, product support, technology, etc.
18	**Define Empowerment.** Empowerment requires *a sincere belief and trust in people.* It involves employees directly in decision-making processes, giving them the security and confidence to make decisions, and providing them with the necessary tools and training.
19	**Distinguish between Reward and Recognition.** Creating incentives for suppliers is one way to ensure that they remain committed to a quality improvement strategy. Incentives may be in the form of a preferred supplier category with its rewards. Recognition may be in the form of publication of outstanding contributions in the customer's newsletter, a letter of commendation, or a plaque.
20	**Why should suppliers be treated as partners?** Costs due to inferior materials/components from suppliers increase costs in the later stages of production. Suppliers themselves are part of the whole system and hence should be treated as long-term partners.
21	**Mention some benefits of implementing 5S principles.** 5S increases productivity, eliminates waste, reduces inventory, creates a pleasant workplace, improves safety, and increases the overall efficiency and effectiveness of people and machines
22	**What are the functions of quality circles? (May/June 2016)** QC is a small team of people coming from the same work area/department who voluntarily meet on a regular basis to identify,investigate,analyse and solve work related probems.They improve quality and productivity, concentrate on cost reduction, plan effective utilization of resources, avoid unnecessary errors, defects etc.
23	**How employee involvement can be improved in an organization? (Nov/Dec2016)** 1.Use the right employee involvement survey. 2.Focus on involvement at the local and organizational levels

	3.Select the right managers 4.Coach managers and hold them accountable for their employees' involvement 5.Define involvement goals in realistic, everyday terms
24	**What are internal failure costs?** These are costs required to identify, repair, replace, or dispose off defective products/services prior to delivery to the customer.
25.	**Write the requirements of reliable supplier rating . (Nov/Dec2016)** Supplier rating system requires 3 key factors: 1.An internal structure to implement and sustain the rating program 2.A regular and formal review process 3.A standard measurement system for all suppliers.
26.	**List any four benefits of Employee Involvement. (May/June 2016)** Conformance, Acceptance, Contribution, Commitment, Cooperation, , Accountability and Ownership.
27.	**Why team and teamwork are required in TQM?*(April/May 2017)*** Teams are formed when individuals with a common preference, liking, and attitude come and work together for a common goal. Teams play a very important role in organizations. Team work is essential in corporates for better output and a better bonding among employees.
	PART-B
1	**Write a note on quality planning and strategic quality planning.(April,2014) (Nov/Dec2016**) The steps involved in quality planning are: 1. Identify your customers, 2. Find out their needs, 3. Translate them into technical requirements, 4. Develop the product, 5. Develop and validate the process, and 6. Translate the resulting plan to the operating personnel. **STRATEGIC QUALITY PLANNING** **Seven Steps to Strategic Planning** *There are seven basic steps to strategic quality planning. The process starts with the principle that qualityand customer satisfaction are the center of an organizations future. It brings together all the key stakeholders.* **1. Customer needs:** The first step is to discover the future needs of the customers. Who will they be? Will your customer base change? What will they want? How will the organization meet and exceed expectations? **2. Customer positioning:** Next, the planners determine where the organization wants to be in relation to the customers. Do they want to retain, reduce, or expand the customer base? Products or services with poor quality performance should be targeted for breakthrough or eliminated. The organization needs to concentrate its efforts on areas of excellence. *No two individual is same, so every type of customer should be treated as per his/herprofile. You cannot sell a premium product to a price conscious customer.* **3. Predict the future:** Next, the planners must look in to their crystal balls to predict future conditions that will affect their product or service. Demographics, economic forecasts and technical assessments or projections are tools that help predict the future.More than one organizations poduct or service has become obsolete because it failed to foresee the changing technology. *If the top management can foresee the future then it helps enable the* *organization to prepare for future changes. Let us take example of SONY. With rapid change in technology SONY has changed its product portfolio, so it is now MP3 player instead of Walkman which we get from SONY.* **4. Gap analysis:** Gap analysis is about the difference between what needs to be done and what are we currently doing. It can give a clue about whether the organization should increase or decrease

	capacity for a particular product. **5. Closing the gap:** If there are gaps then long term plans should be about how to fill that gap. **6. Alignment (with vision and mission):** Whatever quality goals an organization is chalking out it should not lose focus from the long term vision and mission of the organization. **7. Implementation:** Once every plan about goals is ready then the next step should be to plan about the methodologies of implementation.
2	**Explain the different types of Teams. (Dec 2011)** A *team* is defined as a group of people working together to achieve common objectives or goals. *Teamwork* is the cumulative actions of the team in which each member of the team subordinates his individual interests to fulfill the objectives or goals of the group. **Process improvement teams:** The members represent each operation of the process. When the targeted process includes many work units or the entire organization, a cross-functional team may be more appropriate with work unit teams operating as sub-teams. The life cycle of this type of team is usually temporary – it is disbanded when the objective has been achieved. **Cross-functional teams:** The members represent a number of different functional areas such as engineering, marketing, accounting, production, quality, and human resources. It may also include the customer and/or the supplier. A design review team is a good example of a cross-functional team. This type of team breaks down functional area boundaries. **Problem-solving teams:** Members gather to solve a specific problem and then disband. **Project teams:** Teams with a specific mission to develop something new or to accomplish a complex task. **Self-directed/self-managed work teams:** They are the epitome of the empowered organization – they not only do the work but also manage it. There is wide discretion to organize their work subject to organizational work flow requirements.
3	**Explain all the elements in 5'S principle and also the implantation procedure of 5'S in a manufacturing company. (Dec 2011)** * The 5S's stand for five Japanese words: **Seiri, Seiton, Seiso, Seiketsu,** and **Shitsuke.** The 5S is not only useful to improve the physical environment, but also the thinking processes. **1. Seiri (Sort):** Separate out all unnecessary things and remove them, retaining only necessary things. Accumulation, mixing of unnecessary things and wastes with needed items leads to clutter, confusion and mess, thereby reducing the efficiency of working. Seiri also involves keeping the number of things as low as possible and at a convenient location. If the workplace is clean, there is greater motivation to carry out the job; but if the place is full of unwanted things, it will be difficult to work effectively. **2. Seiton (Arrange):** Put required things in proper order so that they can be easily accessed for use and quickly put away in their proper locations after use. It prevents people from wasting their time searching for things. *"A place for everything and everything in its place".* **3. Seiso (Clean up):** Keep machinery and work environment clean. Employees should be responsible for cleaning their own workplaces. Workers should clean up the workplace first thing before they commence work and at the end of the day before they leave. They should also see that their workplace remains clean and tidy throughout the day. Any dirt, spillage, etc. should be attended to immediately. If cleanliness is not maintained, it can be harmful to the personnel [health hazards], machinery [can fail due to dust, dirt, etc.], and materials [due to contamination], thereby causing quality and productivity problems. **4. Seiketsu (Systematize, Standardize):** Develop routine practices for orderly, systematic working. If the 5S processes are standardized, it becomes easier to continuously maintain the organization's neatness and cleanliness. An effective means of achieving *Seiketsu* is Visual management – like signboards, marked parking lots, marking of aisles, identification labels, etc. Another important consideration is transparency – tools, files, etc. should be visible so that it is easy to locate them. This will reduce the time for searching. **5. Shitsuke (Discipline):** Impart systematic training and coaching to ensure discipline in 5S

	implementation. Discipline comes through repetition and practice. Self-discipline goes beyond discipline. It is essential for the successful implementation of the 5S principles. * In a factory, 5S increases productivity, eliminates waste, reduces inventory, creates a pleasant workplace, improves safety, and increases the overall efficiency and effectiveness of people and machines. * The logic behind the 5S principles is that organization, neatness, cleanliness, standardization, and discipline at the workplace are basic requirements for producing high quality products and services, with high productivity and little or no wastage; hence the importance of combining the 5S principles in TQM.
4	**Write about the system of recognition and reward followed in an organization. (Dec 2011)** **Recognition** is a form of employee motivation in which the organization publicly acknowledges the positive contributions an individual has made to the success of the organization. This acknowledgement is delivered using verbal and written praise and may include symbolic items such as certificates and plaques. **Reward** is something tangible such as theater tickets, dinner for two, or a cash award to promote desirable behaviour. ***Recognition and reward go together to form a system for letting people know they are valuable members of the organization.*** People like to be recognized, either as a team or individually. A persons feeling of achievement, value to the organization, knowing the organization cares and having peer recognition may be more important than any reward. **Recognition Includes** Pictures on the bulletin board Articles in newsletters or newspapers Letters to families Making a presentation to management Passing along compliments from others Personal phone calls or notes Placing positive notes in folders Increased responsibility **Rewards** **Individual Rewards** Better parking space Dinner out Gift certificates Gift to charity in the name of the recipient Washing an employee's car during lunch hour Trips Event tickets **Group Rewards** Includes an outing such as a ball game, bowling and movies Group lunch or dinner ***"Cash awards are also effective motivators for individual and team awards."***
5	**What are the steps involved in continuous improvement process. (Dec 2011)** Continuous improvement is an inherent part of the TQM process. It transforms the drive towards quality into a never-ending journey. This concept allows companies to start with modest beginnings and make small incremental improvements towards excellence. + Effective continuous improvement needs the support of performance measurement methods. Performance measurement systems help people to identify and measure, in quantitative terms, the sizes of improvements. *** Steps in Continuous Improvement Strategy:** ***1. Define the current status:*** This can be addressed from any of several perspectives *viz.* number of defects, cost of defects, customer satisfaction indices, and the like. ***2. Define continuous improvement objectives:*** While the first step asks the question "where are

	we?" the second step asks the question "where should we be going?". The objectives should be based on a realistic appraisal of what the organization, with its available resources, is capable of achieving. It is better to set modest improvement goals at first to realize a few initial successes, which will help to motivate employees to accept the continuous improvement philosophy. ***3. Select continuous improvement projects:*** These are the specific areas in which the organization desires to seek improvement. Some examples of improvement projects are: [i] frequent product failures during final testing, [ii] delayed payments to suppliers, [iii] delays in attending to machine breakdowns. Each of these projects provide the framework of an action plan for the organization to realize continuous improvement. ***4. Assign teams:*** After selecting the projects, the organization has to assign people to work on these projects and empower them to attain the continuous improvement objectives set. The concepts of *employee involvement, empowerment and teamwork* are extremely important to achieve *continuous improvement* as they allow an organization to achieve significant synergies and fully utilize its human resources. ***5. Define the process:*** Once a team has been assigned a project, the first task of the team is to define the process it is assigned. This is done by preparing a flow chart for the process. Flow charts provide the visibility of the entire process to all those who work on the process. It also reveals various problem areas and inefficiencies. Each step in the process should be critically examined by asking the question: *What happens if this step is eliminated?* If nothing happens, then that particular step should be removed from the process. ***6. Define sources of variability:*** The next step is to identify areas in which variability can creep into the process. Reducing variability is another key concept of TQM, because anything done to reduce variability will result in improved quality. Two sources of variability are *chance causes* and *assignable causes.* Variability reduction focuses on ensuring that the assignable causes (due to human factors) are eliminated from the process. According to Deming, 85% of a company's quality problems are due to variability induced by problems in the process and not workmanship. Eliminating process deficiencies and minimizing process variability will prevent future defects. ***7. Implement change:*** Formulate a pilot program in a small area to test the effectiveness of the suggested improvement project. Based on feedback indicating any glitches and problem areas, make suitable modifications and go in for full-scale implementation. Continue to monitor the process using the same measurement criteria once the upgrade has been fully implemented.
6	**List the five levels in Maslow's Hierarchy of needs and describe in detail each level.** Maslow's hierarchy consists of physical (survival), security, social, esteem, and self-actualization needs. Once a given level is satisfied, it ceases to be a motivator, and the next higher level need becomes the motivator. + Level 1 needs of food, clothing, and shelter are usually provided by a job. Level 1 needs also include a conducive working environment such as proper lighting, ventilation, fan, A/C, etc. + Level 2 (security) can mean a safe place to work and job security. It also includes having privacy on the job such as separate cabin, lockable storage for personal items, etc. + Level 3 (social) needs involve giving a person the opportunity to be part of a group. Employees should also be provided with both formal social areas such as conference rooms and cafeterias, and informal areas such as water coolers and bulletin boards. Being a member of a team is a good way to meet the social needs of an individual. + Level 4 (esteem) needs: Everyone, regardless of position or nature of job, wants to be recognized as a person of value to the organization. Provision of business cards, separate work space, office protocols, etc. provides employees with a certain level of self-esteem. + Level 5 (self-actualization) says that individuals must be given the opportunity to go as far as their abilities will take them. In this regard, many organizations have a policy of promoting from within.
7	**What are the characteristics of empowered employee? And also discuss the benefits of empowered environment.** **Characteristics of empowered employees:** [1] They feel responsible for their own task. [2] They are given a free hand in their work. [3] They balance their own goals with those of their organization. [4] They are well trained, equipped, creative, and customer oriented. [5] They are critical, have self-

esteem, and are motivated. [6] They monitor and improve their work continuously. [7] They constantly seek new goals and challenges.

+ **Benefits of empowerment:** [1] It builds confidence in workers by showing them that the company has confidence in their ability to make decisions on their own. [2] It generates commitment and pride in employees. [3]It gives employees better experience and an opportunity to advance their careers. [4] It benefits customers by reducing bureaucratic red tape that customers encounter – such as seeking a superior's approval/signature – which makes customer transactions speedier and more pleasant.

8 **Explain in detail the concept of Employee involvement.**

Employee involvement (EI) refers to any activity by which employees participate in work-related decisions with the aim of tapping the creative energies of all employees and improving their motivation.

+ The various levels of employee involvement is summarized in the following table. As total quality matures in an organization, higher levels of employee involvement become evident.

Level	Action	Primary outcome
1. Information sharing	Managers decide, then inform employees	Conformance
2. Dialogue	Managers get employee input, then decide	Acceptance
3. Special problem solving	Managers assign a one-time problem to selected employees	Contribution
4. Intra-group problem solving	Intact groups meet weekly to solve local problems	Commitment
5. Inter-group problem solving	Cross-functional groups meet to solve mutual Problems	Cooperation
6. Focused problem solving	Intact groups extend daily involvement in a specific issue	Concentration
7. Limited self-direction	Team functions with minimum supervision	Accountability
8. Total self-direction	Executives facilitate self-management	Ownership

+ EI is rooted in the psychology of human needs and supported by the motivation models of Maslow, Herzberg, and McGregor. Employees are motivated through exciting work, responsibility, and recognition. EI provides a powerful means of achieving the highest order individual needs of self-realization and fulfillment, thereby improving employee morale and commitment, with resultant improvements in quality and productivity.

+ One of the easiest ways to promote employee involvement is the **suggestion system.** It is a management tool for the submission, evaluation, and implementation of an employee's idea to save cost, increase quality, or improve other elements of work such as safety.

+ Major factors contributing to employee involvement are: motivation, compensation, recognition & reward system, working environment, organization culture and climate, leadership, and empowerment.

9 **Write short note on: Supplier partnership, Partnering, supplier selection, supplier rating. (Nov/Dec2016)**

Supplier Partnership.

+ An organization spends a substantial portion of its resources on the purchase of raw materials, components, and services. Therefore, supplier quality can greatly affect the overall cost and quality of a product or service. It is important for the customer to work with suppliers in a partnering atmosphere to achieve high quality levels in its end products and services.

+ Organizations (customers) and their suppliers have the same goal – to satisfy the end user. Since both the customer and the supplier have limited resources, they must work together as partners for their mutual benefit.

+ There have been a number of forces that have changed supplier relations. Prior to the 1980s,

purchase decisions were typically based on price, thereby awarding contracts to the lowest bidder. As a result, quality and timely delivery were sacrificed. The advent of the TQM philosophy exemplified by Deming's fourth point *(Stop awarding business based on price alone)* addressed this problem.

Another force changing supplier relations was the introduction of the just-in-time (JIT) concept. It calls for raw materials and components to reach the shop-floor in small quantities when they are needed and not before. As a result, the supplier will have many more process setups, thus becoming a JIT organization itself.

The practice of continuous process improvement has also caused many suppliers to develop partnership with their customers. Suppliers are now taking increased product-development responsibilities. They are becoming involved in product design, formation of specifications, and component testing.

A final force is ISO 9000 which requires suppliers to work towards zero defects, 100% on-time delivery, and a process for continuous improvement.

All these forces have changed adversarial customer-supplier relationships into mutually beneficial partnerships. Joint efforts improve quality, reduce costs, and increase market share for both parties.

PARTNERING

+ Partnering is a long-term commitment between two or more organizations for the purpose of achieving specific business goals. The relationship is based upon trust, dedication to common goals, and an understanding of each participant's expectations and values. Benefits include improved quality, increased efficiency, and lower cost.

+ There are three key elements to a partnering relationship: *long-term commitment, trust,* and *shared vision.*

1. Long-term commitment: Long-term commitment provides the needed environment for both parties to work toward continuous improvement. Each party contributes its unique strengths to the processes. A supplier might not take risks, such as acquiring new equipment or systems, without a long-term commitment.

2. Trust: Mutual trust forms the basis for a strong working relationship that is non-adversarial. The purchasing function must be subordinate to the overall relationship goals and objectives. Open and frequent communication avoids disputes while strengthening the relationship. The parties should have access to each other's business plans and technical information, such as product and process parameters. In addition, they may share or integrate resources such as training activities, administrative systems, and equipment. Both parties become motivated when "win-win" solutions are sought rather than "win-lose" solutions.

3. Shared vision: Each of the partnering organizations must understand the need to satisfy the final customer. Shared goals ensure a common direction and must be aligned with each party's mission. Employees of both parties should think and act for their common good. Decisions must be formulated and implemented as a team.

SUPPLIER SELECTION

+ Before deciding on suppliers, the organization has to decide whether to produce or outsource a particular item. This decision is a strategic one and must be made after answering the following questions: *How critical is the item to the design of the product or service? Does the organization have the technical knowledge to produce the items internally? Are there suppliers who specialize in producing the item?* These questions must be answered in terms of cost, delivery, quality, safety, and the acquisition of technical knowledge.

+ Once the decision has been made to outsource, then the supplier must be selected. The following are some important criteria for evaluation and selection of suppliers:

- The supplier has the capability to produce the item in quantities needed by the organization.
- The supplier has excellent quality practices and a commitment to quality.
- The supplier maintains high technical standards and has the capability of dealing with future technological innovations.
- The price is right and the delivery dates can be met.
- The supplier is easily accessible in terms of transportation and communication.
- The supplier has a track record of customer satisfaction and organization credibility.
- The supplier has an effective quality system and improvement program such as ISO 9000.

- The supplier understands and appreciates the management philosophy of the organization.

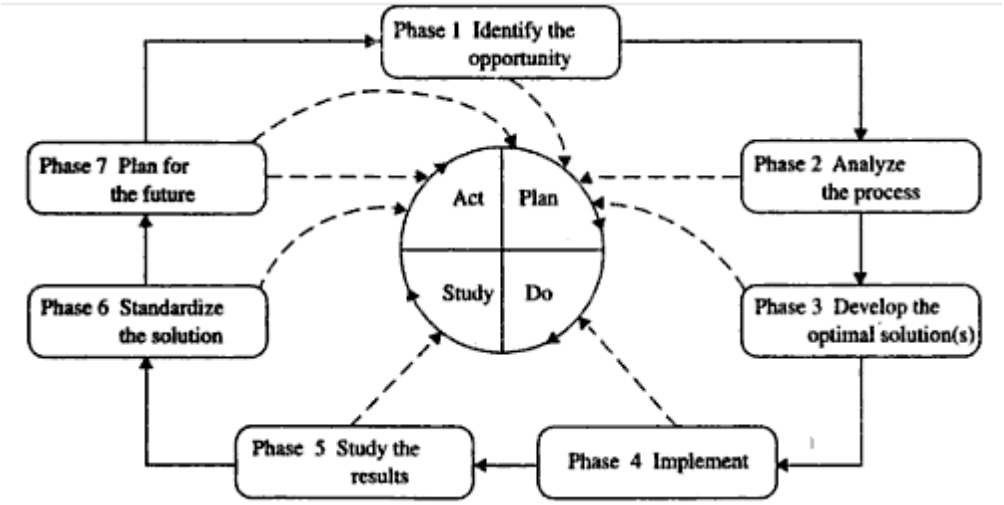
SUPPLIER RATING

* The customer rates suppliers to: [i] obtain an overall rating of supplier performance, [ii] ensure complete communication with suppliers regarding their performance in the areas of quality, service, delivery, and other measures the customer desires, and [iii] provide each supplier a detailed, factual record of problems for corrective action.
* A supplier rating system (often called a scorecard system) is usually based on quality, delivery, and service; however, some customers have added other categories, such as lead time, product support, technology, etc. These categories may also have subcategories.
* These basic categories are weighted, with quality usually given the greatest weight. A score is given to each category by means of a numerical value or a letter grade, which can then be converted to a numerical value.
* Reports are prepared and issued quarterly, and overall grades are provided to each supplier. The basic objective of such supplier rating systems is to have high quality, dependable suppliers in the long run.

10 **Give a detailed note on PDCA cycle(Nov/Dec2016)**

PDSA CYCLE

- The concept was first given by Deming and later it was developed by Shewhart.
- It is also known as **Deming cycle** or **PDCA cycle.**



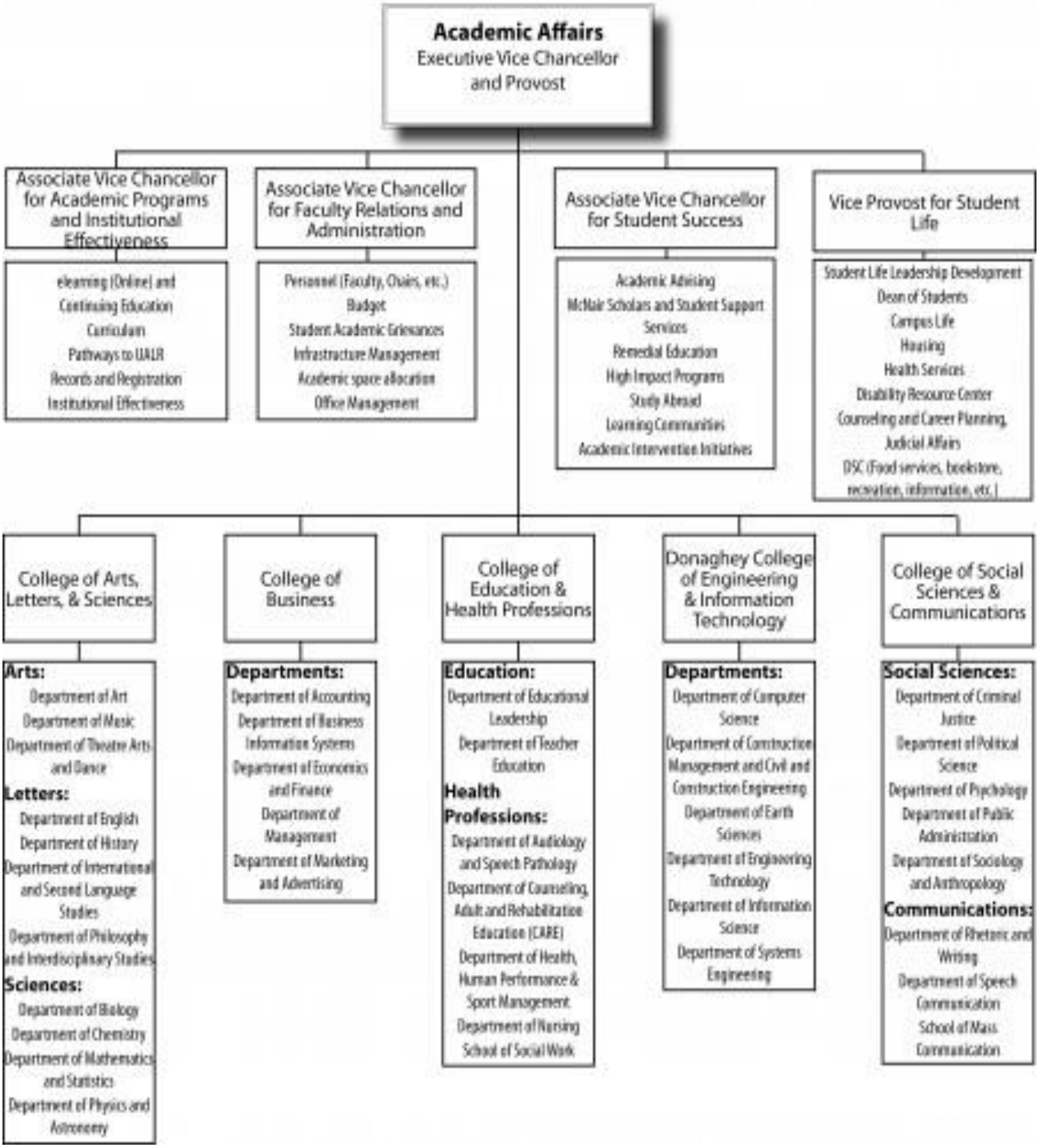
Identify the opportunity:

- The objective of this phase is to identify and prioritize opportunities for improvement.
- It has three parts
- Identify the problem
- Form the team
- Define the scope.

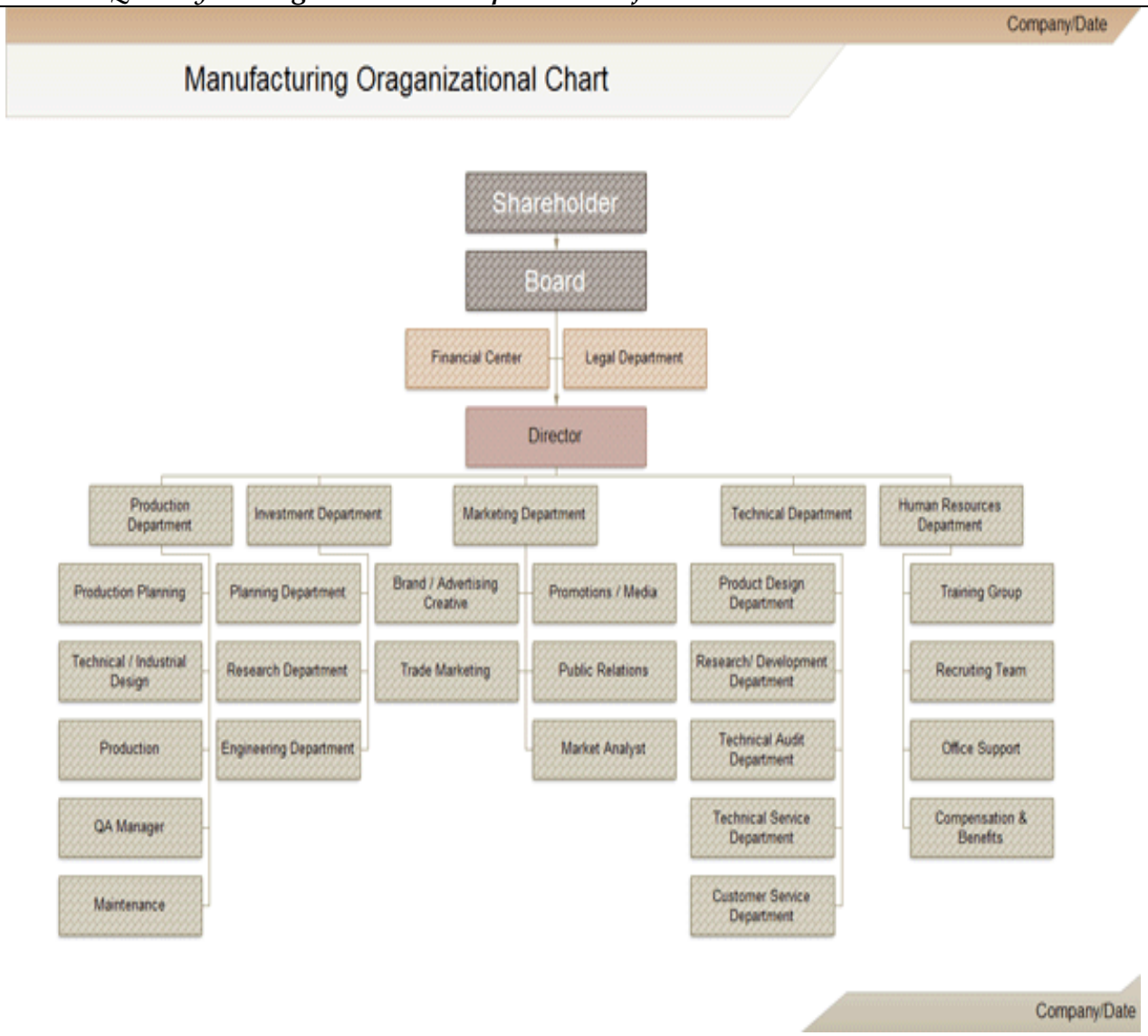
Analyze the current process:

- The objective of this phase is to understand the process and how it is currently performed.
- Key activities are to define process boundaries outputs and customers, inputs and suppliers and process flow, determine levels of customer satisfaction and measurements needed, gather data and identify root causes.
- With the help of process flow diagram the team will
- Establish performance measures with respect to customer requirements.
- Determine data needed to manage the process
- Establish regular feedback with customers and suppliers.
- Establish measures for quality/cost/time of inputs and outputs.
- Once the target performance measures are established, the team can collect all available data and information.
- Gathering data by the team
- Helps confirm that a problem exists
- Enables the team to work with facts

	Makes it possible to establish measurement criteria for baseline Enables the team to measure the effectiveness of an implemented solution. The team should develop a plan that includes input from internal and external customers and answers the following questions What problem or operation do we want to learn about? What are the data used for? How many data are needed? What conclusions can be drawn from the collected data? What action should be taken as a result of the conclusion? **Develop the optimal solution:** The objective of this phase is to establish potential and feasible solution and recommend the best solution to improve the process. Once all the information is available the project team begins it search for possible solutions. In this phase creativity plays the major role and brainstorming is the principle technique. There are three types of creativity Create new processes Combine different processes Modify the existing processes **Implement Changes:** Once the best solution is selected it should be implemented. This phase has the objective of preparing the implementation plan, obtaining approval and implementing the process improvements. Although the team has the authority in implementing the solution but it has to get approval from the quality council. If such approval is needed from the quality council, the team has to give a written or oral report. The report should fully describe about Why will it be done? How will it be done? When will it be done? Who will do it? Where will it be done? The length of the report is determined by the complexity of the change. Simple changes may require only an oral report, whereas other changes require a detailed written report. **Study the Results:** This phase has the objective of monitoring and evaluating the change by tracking and studying the effectiveness of the improvement efforts through data collection and review of progress. The team should meet periodically during this phase to evaluate the results to see that the problem has been solved or if fine tuning is required. If the team is not satisfied, then some of the phases will need to be repeated. **Standardize the solution:** Once the team is satisfied with the change, it must be institutionalized by positive control of process, process certification and operator certification. Positrol (positive control) assures that the important variables are kept under control. It specifies that what, who, how, where and when of the process and is an updating of the monitoring activity. **Plan for the future:** This phase has the objective of achieving improved levels of process performance. Everyone in the organization is involved in a systematic, long term endeavor to constantly improve quality by developing processes that are customer oriented, flexible and responsible. **5S PRINCIPLE**
11	Discuss how Quality council is structured in (i) University Academic Department and (ii)Manufacturing facility. ***(May/June 2016)*** **University Academic Department**



ii)Manufacturing facility.



12 (i)**Explain the phases of PDSA cycle and its illustration. (May/June 2016) (Nov/Dec2016)**

PDSA CYCLE

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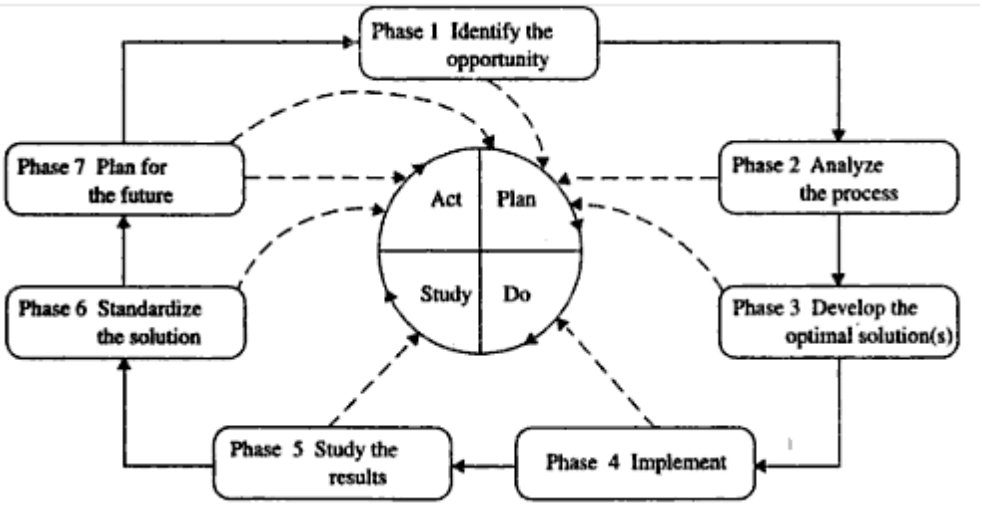

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Analyze the current process:

The objective of this phase is to understand the process and how it is currently performed.

Key activities are to define process boundaries outputs and customers, inputs and suppliers and process flow, determine levels of customer satisfaction and measurements needed, gather data and identify root causes.

With the help of process flow diagram the team will

Establish performance measures with respect to customer requirements.

Determine data needed to manage the process

Establish regular feedback with customers and suppliers.

Establish measures for quality/cost/time of inputs and outputs.

Once the target performance measures are established, the team can collect all available data and information.

Gathering data by the team

Helps confirm that a problem exists

Enables the team to work with facts

Makes it possible to establish measurement criteria for baseline

Enables the team to measure the effectiveness of an implemented solution.

The team should develop a plan that includes input from internal and external customers and answers the following questions

What problem or operation do we want to learn about?

What are the data used for?

How many data are needed?

What conclusions can be drawn from the collected data?

What action should be taken as a result of the conclusion?

Develop the optimal solution:

The objective of this phase is to establish potential and feasible solution and recommend the best solution to improve the process.

Once all the information is available the project team begins it search for possible solutions.

In this phase creativity plays the major role and brainstorming is the principle technique.

There are three types of creativity

Create new processes

Combine different processes

Modify the existing processes

Implement Changes:

Once the best solution is selected it should be implemented.

This phase has the objective of preparing the implementation plan, obtaining approval and implementing the process improvements.

Although the team has the authority in implementing the solution but it has to get approval from the quality council.

If such approval is needed from the quality council, the team has to give a written or oral report.

The report should fully describe about

Why will it be done?

How will it be done?

When will it be done?

Who will do it?

Where will it be done?

The length of the report is determined by the complexity of the change.

Simple changes may require only an oral report, whereas other changes require a detailed written report.

Study the Results:

This phase has the objective of monitoring and evaluating the change by tracking and studying the effectiveness of the improvement efforts through data collection and review of progress.

The team should meet periodically during this phase to evaluate the results to see that the problem has been solved or if fine tuning is required.

	If the team is not satisfied, then some of the phases will need to be repeated. **Standardize the solution:** Once the team is satisfied with the change, it must be institutionalized by positive control of process, process certification and operator certification. Positrol (positive control) assures that the important variables are kept under control. It specifies that what, who, how, where and when of the process and is an updating of the monitoring activity. **Plan for the future:** This phase has the objective of achieving improved levels of process performance. Everyone in the organization is involved in a systematic, long term endeavor to constantly improve quality by developing processes that are customer oriented, flexible and responsible. (ii) **What is 5S and why does the organization adopt this technique? (May/June 2016)** * The 5S's stand for five Japanese words: **Seiri, Seiton, Seiso, Seiketsu,** and **Shitsuke.** The 5S is not only useful to improve the physical environment, but also the thinking processes. **1. Seiri (Sort):** Separate out all unnecessary things and remove them, retaining only necessary things. Accumulation, mixing of unnecessary things and wastes with needed items leads to clutter, confusion and mess, thereby reducing the efficiency of working. Seiri also involves keeping the number of things as low as possible and at a convenient location. If the workplace is clean, there is greater motivation to carry out the job; but if the place is full of unwanted things, it will be difficult to work effectively. **2. Seiton (Arrange):** Put required things in proper order so that they can be easily accessed for use and quickly put away in their proper locations after use. It prevents people from wasting their time searching for things. *"A place for everything and everything in its place".* **3. Seiso (Clean up):** Keep machinery and work environment clean. Employees should be responsible for cleaning their own workplaces. Workers should clean up the workplace first thing before they commence work and at the end of the day before they leave. They should also see that their workplace remains clean and tidy throughout the day. Any dirt, spillage, etc. should be attended to immediately. If cleanliness is not maintained, it can be harmful to the personnel [health hazards], machinery [can fail due to dust, dirt, etc.], and materials [due to contamination], thereby causing quality and productivity problems. **4. Seiketsu (Systematize, Standardize):** Develop routine practices for orderly, systematic working. If the 5S processes are standardized, it becomes easier to continuously maintain the organization's neatness and cleanliness. An effective means of achieving *Seiketsu* is Visual management – like signboards, marked parking lots, marking of aisles, identification labels, etc. Another important consideration is transparency – tools, files, etc. should be visible so that it is easy to locate them. This will reduce the time for searching. **5. Shitsuke (Discipline):** Impart systematic training and coaching to ensure discipline in 5S implementation. Discipline comes through repetition and practice. Self-discipline goes beyond discipline. It is essential for the successful implementation of the 5S principles. * In a factory, 5S increases productivity, eliminates waste, reduces inventory, creates a pleasant workplace, improves safety, and increases the overall efficiency and effectiveness of people and machines. * The logic behind the 5S principles is that organization, neatness, cleanliness, standardization, and discipline at the workplace are basic requirements for producing high quality products and services, with high productivity and little or no wastage; hence the importance of combining the 5S principles in TQM.
13	**Portray the characteristics of Empowered Employees(Nov/Dec2016)** **Characteristics of empowered employees:** [1] They feel responsible for their own task. [2] They are given a free hand in their work. [3] They balance their own goals with those of their organization.

	[4] They are well trained, equipped, creative, and customer oriented. [5] They are critical, have self-esteem, and are motivated. [6] They monitor and improve their work continuously. [7] They constantly seek new goals and challenges.
14	**(i)Enumerate the duties of quality council.*(April/May 2017)*** • The future of quality and its role in innovation • Alignment of quality with the corporate strategic plan and business plan • Customer satisfaction and focus management • Collective problem solving that puts your issue on the agenda • Benchmarking through regular surveys of council members about relevant company practices • Multifunctional insights generated by the wealth of perspectives gathered from over 100 councils (covering more than 50 functions) that work together across geographies • Virtual communities that extend learning opportunities through a variety of online forums and other resources. • Quality council should approve policies. (ii) **Explain McGregor's theory X and theory Y** According to Douglas McGregor, there are two opposing approaches to implementing **Theory X**: the "hard" approach and the "soft" approach. The hard approach depends on close supervision, intimidation, and imminent punishment. This approach can potentially yield a hostile, minimally cooperative work force that could harbor resentment towards management. The soft approach is the literal opposite, characterized by leniency and less strictly regulated rules in hopes for high workplace morale and therefore cooperative employees. Implementing a system that is too soft could result in an entitled, low-output workforce. **Theory Y** is almost in complete contrast to that of Theory X". Theory Y managers make assumptions that people in the work force are internally motivated, enjoy their labor in the company, and work to better themselves without a direct "reward". Theory Y employees are considered to be one of the most valuable assets to the company, and truly drive the internal workings of the corporation. Theory Y states that these particular employees thrive on challenges that they may face, and relish on bettering their personal performance. Workers additionally tend to take full responsibility for their work and do not require the need of constant supervision in order to create a quality and higher standard product.
15	**What do you understand by the term quality statements? Elaborate them with examples .*(April/May 2017)*** ✓ Once developed, they are only occasionally reviewed and updated. ✓ They are the part of the strategic planning process. ✓ The utilization of the three statements varies considerably from organization to organization. **The quality statements are**: 1.Vision statement 2.Mission statement and 3. Quality policy statement. **1.Vision Statement** - The vision is a short declaration of what an organization aspires to be tomorrow. - It is the ideal state that might never be reached but which we continually strive to achieve. - Successful visions are timeless, inspirational and become deeply shared within the organization. - Successful vision provides a guide line for decision making. - It is important that the leader articulate and act upon the vision and those employees understand the vision and can connect their work with the well-being of the organization. **2.Mission Statement** - The mission statement answers the following questions: who we are, who are the customers, what we do, and how we do it. - This statement is usually one paragraph or less in length, is easy to understand and describes the

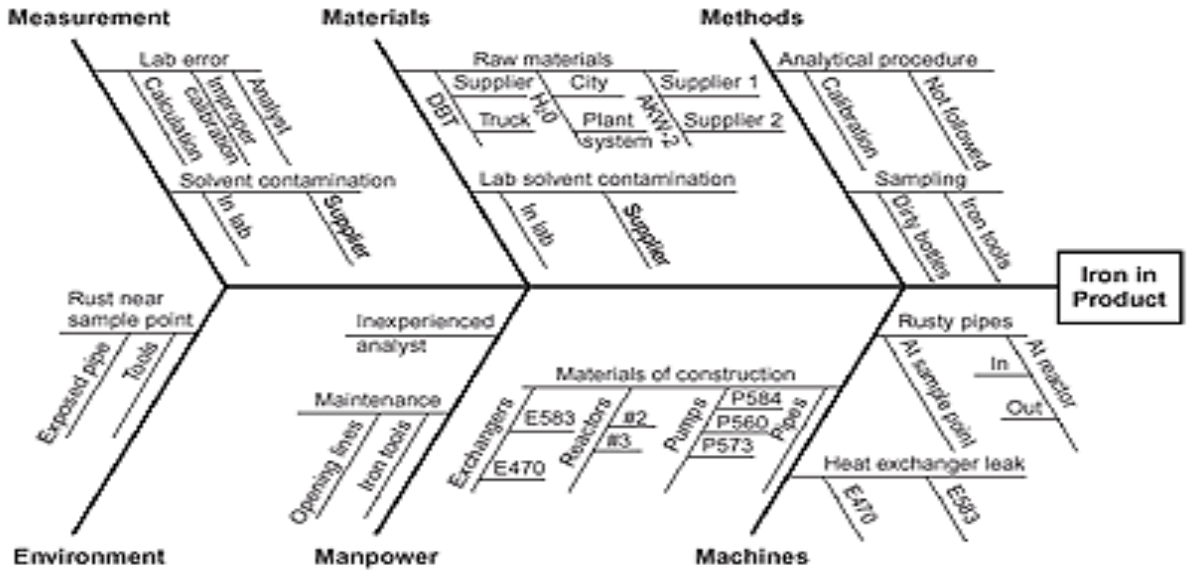
	function of the organization. - It provides a clear statement of purpose for employees, customers and suppliers **3.Quality Policy Statement** - The quality policy is a guide for everyone in the organization as to how they should provide products and services to the customers. - It should be written by the CEO with feedback from the workforce and be approved by the quality council.

UNIT III-TQM TOOLS AND TECHNIQUES

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

PART-A

1	**List the seven tools of quality.** 1. Check sheets. 2. Histograms. 3. Cause and effect diagrams. 4. Pareto diagrams. 5. Stratification analysis. 6. Scatter diagrams, and 7. Control charts.
2	**What is check sheet?** A check sheet or tally sheet is a form for systematic data gathering and registering to get a clear view of the facts.
3	**When do you use the check sheet?** A check sheet is used to indicate the frequency of a certain occurrence.
4	**What are the types of check sheets commonly used?(May /June 2016)** 1. Process distribution check sheet. 2. Defective item check sheet. 3. Defect location check sheet, and 4. Defect factor check sheet.
5	**Write the different concepts of six sigma. (*April/May2017*)** Six sigma is similar to Zero Defects (ZD), is a philosophical benchmark or standard of excellence proposed by Philip Crosby. Six sigma strives for perfection. It allows for only 3.4 defects per million opportunities (or 99.99966 percent accuracy).
6	**What is histogram? When do you use histogram?** A histogram is a bar chart / diagram showing a distribution of variable quantities or characteristics. It is graphical display of the frequency distribution of numerical data. A histogram is used to show clearly where the most frequently occurring values are located and the data is distributed. It enables the analyst to quickly visualize the features of a complete set of data.
7	**What is meant by bench marking? (Nov/Dec2016)** A measurement of the quality of an organization's policies, products, programs, strategies, etc., and their comparison with standard measurements, or similar measurements of its peers.
8	**How to use cause and effect diagram .(Nov/Dec2016)** The cause and effect diagram or Fishbone diagram is a graphical-tabular chart to list and analyze the potential causes of a given problem. It can be used When identifying possible causes for a problem When a team tends to fall into ruts.

	
9	**Under what situations, one can use cause and effect diagram?** The cause and effect diagram has unlimited application in research manufacturing, marketing, office operations, services, etc.
10	**What are the uses of CE diagram?** The cause and effect diagrams are used: 1.To analyse cause and effect relationships 2.To facilitate the search for solutions of related problems. 3.To standardize existing and proposed operations and 4.To educate and train personnel in decision-making and corrective action activities.
11	**What are the various types of histogram?** 1. Bell-shaped. 2. Double-peaked. 3. Plateau. 4. Comb. 5. Skewed. 6. Truncated. 7. Isolated peak and 8. Edged peak.
12	**What is Pareto diagram? State the Pareto principle.** A pareto diagram is a diagnostic tool commonly used for separating the vital few causes that account for a dominant share of quality loss. Pareto principle states that a few of the defects accounts for most of the effects.
13	**What are the purposes of pareto principle.** Pareto analysis can be used in a wide range of situations, where one need to priorities problems based on its relative importance.
14	**What is stratification?** Pareto analysis can be used in a wide range of situations, where one need to priorities problems based on its relative importance.
15	**What is scatter diagram?** The scatter diagram is a simple graphical device to depict the relationship between two variables.
16	**When do you use the scatter diagram?** The purpose of the scatter diagram is to display what happens to one variable when another variable is changed.

17	**Define statistics applications of statistical techniques?** Statistics is defined as the science that deals with the collection, tabulation, analysis, interpretation and presentation of quantitative data.
18	**What are major functions of statistical analysis? Write down the applications of statistical techniques?** The major functions of statistical analysis are: Reducing the complexity of the situation, Making comparisons and drawing conclusions, Estimating and predicating, and Decision-making. Statistical techniques are applicable in all situations where quantification is possible. The statistical analysis has become indispensable to practically every field that exists.
19	**What are the types of graphs used in representing frequency distribution?** Histogram, Frequency polygon and frequency curve, and Cumulative frequency or the 'Ogive'
20	**How do obtain frequency curve?** A frequency curve is obtained by drawing a smooth freehand curve through the points of the frequency polygon. The cumulative frequency curve (also called an Ogive) obtained by plotting upper class limits (or lower class limits) against the 'less than' (or 'more than') cumulative frequencies is known as 'less than' Ogive (or 'more than' Ogive).
21	**What do you mean by measure of central tendency? What are the three measures of central tendency?** A measure of central tendency of a distribution is a numerical value that describes the central position of the data. 1.Mean, 2.Median and 3.Mode.
22	**What are the three measures of dispersion?** Measures of dispersion tell us how the individual observations are spread on either side of the center. 1. Range, 2.Mean deviation and 3. Standard deviation
23	**What is meant by attribute? What is the use of control charts for attributes?** 1.An attribute refers to those quality characteristics that confirm to specifications or do not conform to specifications. 2.Control charts for attributes monitor the number of defects or fraction defects or fraction defect rate present in the sample. 3.p chart: The chart for fraction rejected as non-conforming to specification 4.np chart: The control chart for number of non-conforming items. 5.c chart: The control chart for number of defects. 6.u chart: The control chart for number of defects per unit.
24	**Define fraction defective (p).** It is defined as the ratio of the number of defective articles found in any inspection to the total number of articles actually inspected. Mathematically, **P = np/n** Where, P= Fraction defective, np = Number of defectives, and n = Number of items inspected in the sub-group

25	**Write the specific use of np-chart. (Nov/Dec2016)** Np-charts are used to determine if the process is stable and predictable, as well as to monitor the effects of process improvement theories.
26	**Write down the difference between a defect and defective.** An item is said to be defective if it fails to conform to the specifications in any of the characteristics. Each characteristics that does not meet the specifications is called defect. For example, if a casting contains undesirable hard sports, below holes, etc., the casting is defective and the hard spots, below holes, etc., are the defects.
27	**Differentiate between producer's risk and consumer's risk** Producer's risk: It is the probability of rejecting a good lot which otherwise would have been accepted. Consumer's risk: It is the probability of accepting a defective lot which otherwise would have been rejected.
28	**What are the five phases in six sigma process?** The five phases in six sigma process are: 1. Define, 2. Measure 3. Analyze 4. Improve and 5. Control
29	**Brief the scope of six sigma principle.** The six sigma concept is originated from manufacturing field. Now it is applied to non-manufacturing processes also. Today one can apply six sigma to many fields such as services, medical and insurance procedures, call centres, etc.
30	**What are the types of check sheets commonly used?** a)Process distribution check sheet b)Defective item check sheet c)Defect location check sheet d)Defect factor check sheet
31	**State the primary objectives of six sigma.*(April/May2017)*** The primary objective of six sigma is to reduce the process variability σ (standard deviation) from the target (mean μ)
32	**Mention the use of Stratification chart in TQM.*(April/May2017)*** Stratification chart is a used for data analysis. When data from variety of sources have been lumped together this chart separates the data so that patterns can be seen. Stratification is a method of analysis of data by grouping it in different ways. It is a simple, very effective QC tool for improving the quality. Collect data about only problem in product / defects ↓ Consider potentially significant way of grouping data on basis of factors experienced ↓ Repeat data through graphic manner reflecting stratification ↓ Analyse results and try new grouping

PART-B

1 **What is six sigma concept? How can it be effective in a service organization.(Nov/Dec2016)**

- **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 qualities are 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.

THE CONCEPT OF SIX SIGMA

Before studying the concept of six sigma, first let us re-introduce the concept of process capability ratio (C_p)

Process capability ratio,

$$C_p = \frac{\text{Design width}}{\text{Process width}} = \frac{USL - LSL}{UCL - LCL}$$

USL = Upper Specification Limit;
LSL = Lower Specification Limit,

(Assumption is that process is centered midway the specification limits, i.e., there is no shift in process mean)

Process capability ratio measures how well the product requirements match with the process capabilities. The higher the value of Cp' the better the match between product and process.

Different Cp values with different process spreads (σ's)

Process variability	C_p	Total amount outside limits	Typical actions to be taken
2σ	0.67	4.56% (45500 ppm)	Heavy process control, sorting rework, etc.
3σ	1.0	2700 ppm	Heavy process control, inspection
4σ	1.33	64 ppm	Reduced inspection, selected use of control charts
5σ	1.67	1 ppm	Spot checking, selected use of control charts
6σ	2	0.001 ppm	Reduced need for control, uniformity in process inputs

USL - Upper Specification Limit LSL – Lower Specification Limit

2,3 **Define Histogram. Mention its types. Illustrate with an example./ Discuss about Types of histograms and their interpretations.**

What is it?

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

It is a graphical display of the frequency distribution of the numerical data.

The data are displayed as a series of rectangles of equal width and varying heights.

ii. When do we use it?

A histogram is used to show clearly where the most frequently occurring values are located and the data is distributed.

It is also a tool for determining the maximum process results.

It enables the analyst to quickly visualize the features of a complete set of data.

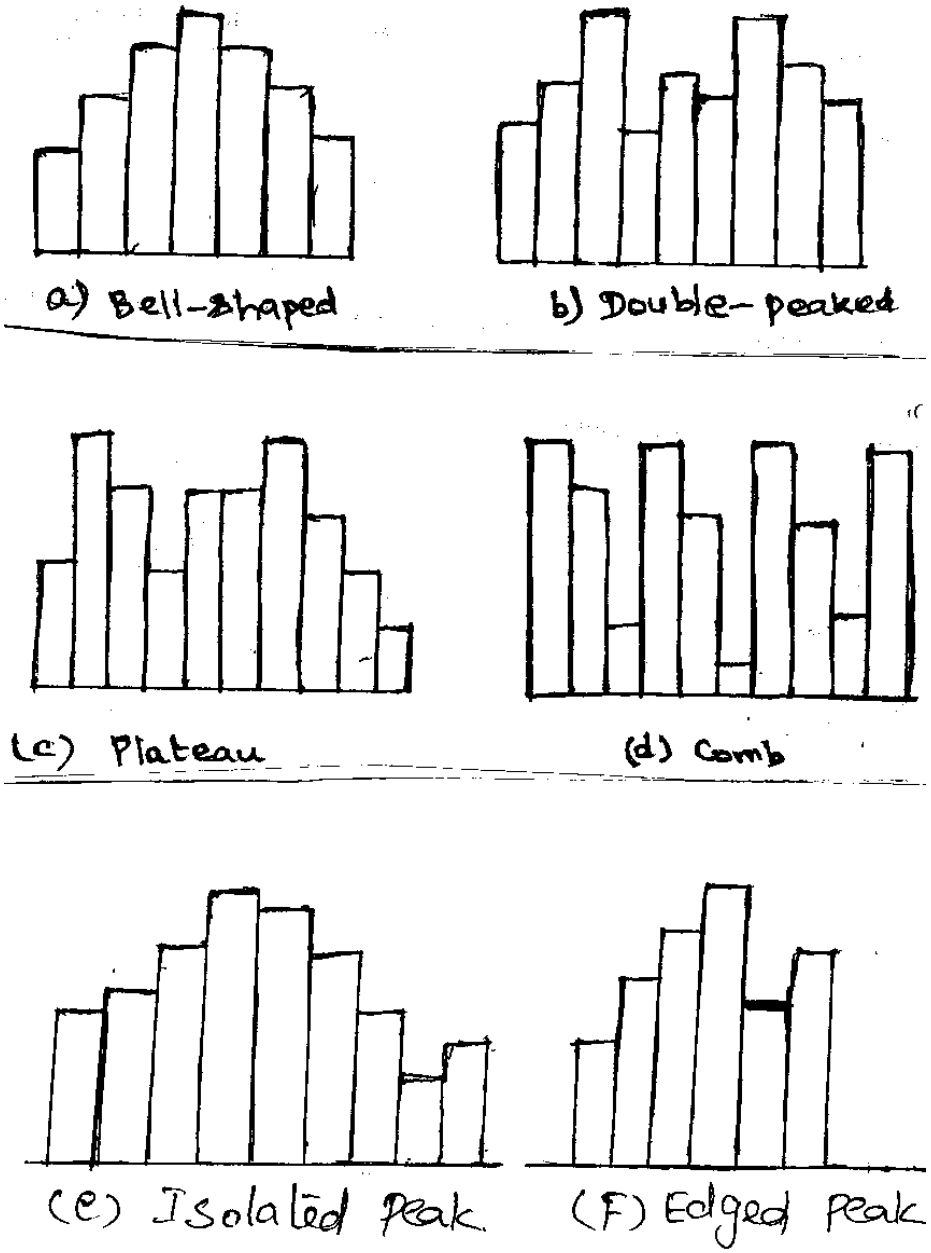
iii. How do we construct it?

A histogram may be constructed using the following steps:

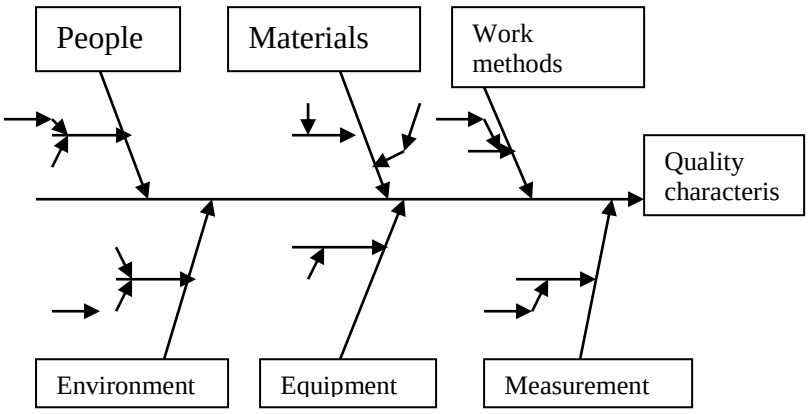
1. After the data collection, count the number of data values collected.
2. Determine the range of the data.

Range = Highest value – Lowest value

Shape	Description
Bell-shaped	Symmetrical shape with a peak in middle representing a normal distribution
Double - Peaked	Two normal distribution with two peaks in middle indicating more than one distribu at work
Plateau	Flat top, no distinct peak and tails indicating more than one distribution at work.
Comb	Alternative peaks showing possible errors in data collection and analysis.
Skewed	An asymmetrical shape positively or negatively skewed – usually reflecting limits ir specification on one side.
Truncated	An asymmetrical shape with a peak at the end. Usually being a part of a no distribution with part of it having been removed.
Isolated peak	Two normal distributions suggesting two processes taking place at the same time.
Edged Peak	A normal distribution curve with a large peak at one end indicating errors in recoding.



4	**Explain the cause and effect diagram (or) fishbone diagram.** What is it? The cause and effect (CE) diagram is a graphical-tabular chart to list and analysis 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. Fig illustrates the basic structure of a cause and effect diagram.



As shown in fig the diagram consists of a central stem leading to the effect (the problem), with multiple branches coming off the stem listing the various groups of possible causes of the problem.

When do we use it?
The CE diagram has unlimited application in research, manufacturing, marketing, office operations, services and so forth.
The CE diagrams are used:
To analyse cause and effect relationships;
To facilitate the search for solutions of related problems;
To standardize existing and proposed operations; and
To educate and train personnel in decision-making and corrective-action activities.

How do we construct it?
The cause and effect diagram may be constructed using the following steps:

- Define the effect (the problem) clearly and concisely.
- Mark the short description of the effect in a box. Then draw a line from this box towards left.
- List down all the possible minor and major causes through a brainstorming* session.
- Mark the major causes on the branches and minor causes in the sub-branches of the CE diagrams.
- Look for possible solutions for these causes.
    - Introduce the changes.

5

Define pareto diagram. Explain how to construct it? Also explain the stratification Analysis.

What is it?

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

When do we use it?
Pareto analysis can be used in a wide range of situations where one need to priorities problems based on its relative importance.
It can be used as a risk assessment technique from activity level to system level.
How can we construct it?

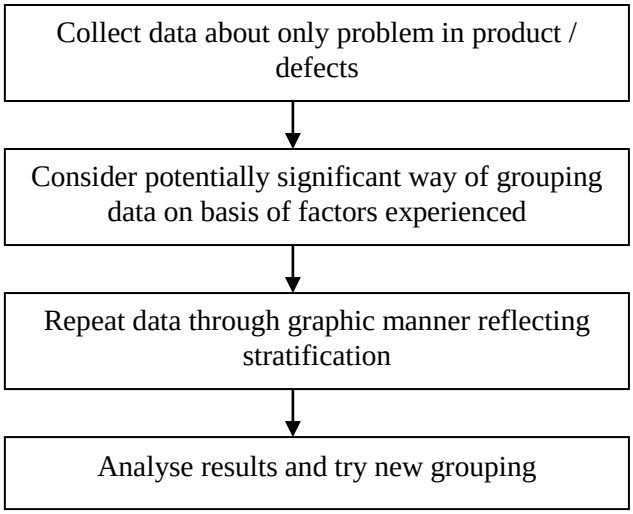
A Pareto diagram can be constructed using the following steps:

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

STRATIFICATION ANALYSIS

What is it?

- ***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 into several sub-groups on the basis of certain characteristics. These stratified data are used for identifying the influencing factors.
- Machines, suppliers, operators, tools gauges or time-dependent sources like shifts, prepost lunch, start or end of shifts, etc., are strata with respect to which the study of various is conducted for diagnosis and possible control/prevention of variations.
- Thus stratification is a simple, very effective QC tool for improving the quality.



Stratification *Analysis procedure*

6 **Define the scatter diagram. Mention its types.**

What is it?

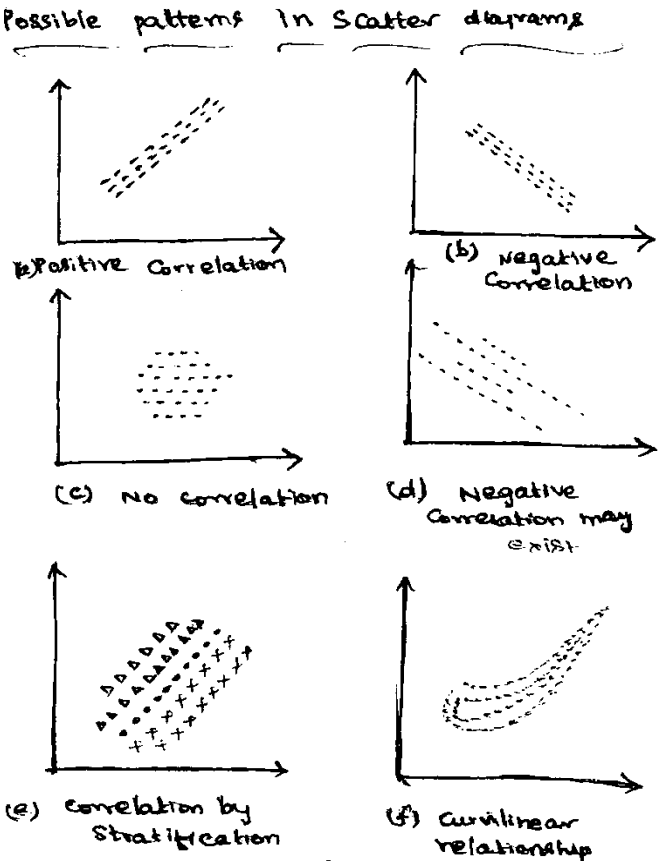
- ***The scatter diagram*** is a simple graphical device to depict the relationship between two variables.
- A scatter diagram is composed of a horizontal axis containing the measured values of one variable (independent, i.e., cause) and a vertical axis, representing the measurements of the variable (dependent, i.e., cause) and a vertical axis, representing the measurements of the variable (dependent, i.e., effect).
- This diagram display the paired data as cloud of points. The density and direction of the cloud indicate how the two variables influence each other.
- Although this diagram cannot prove that one variable causes the other, but they do indicates the existence of a relationship as well as the strength of that relationship.

Types of Scatter Diagram Patterns

The possible patterns i.e., shapes of clouds are depicted in Fig.(a) to (f).

When do we use it?

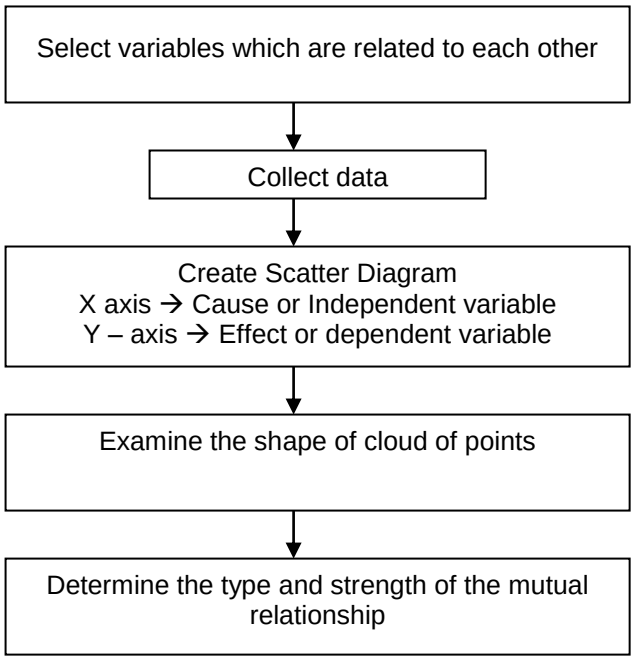
- The purpose of the scatter diagram is, therefore, to display what happens to one variable when another variable is changed.
- This diagram is used to understand, why particular variations occur and how they can be controlled.



How do we construct it?

The sequence of steps used to construct the scatter diagram is outlined in Fig. 6.10.

Construction of a Scatter Diagram



7 **Explain briefly about check sheet (or) data collection sheet with an example.**

Check sheet (data collection sheet)

i. What is it?

- A check sheet*, also known as tally sheet, is a form for systematic data gathering and registering to get a clear view of the facts.
- It is used to keep track of how often something occurs.
- The form of the check sheet is tailored for each situation / application.

ii. When do we use it?

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

iii. How do we construct it?

- A checklist may be constructed using the following steps:
- Formulate the objective for collecting data
- Decide which data is necessary.
- Determine who and how data will be analyzed.
- Draw a format to record data.
- Collect and record data problem-wise by putting tally lines.
- Start counting by tallying on the list; |, ||, |||, |||| and |||| represent the numbers 1,2,3,4 and 5 respectively.
- Mark on the list the total number of facts, which were noticed.

iv. Types of check sheets

The widely used different types of check sheets are:

Process distribution check sheet:

This check sheet is used to collect on process variability.

Defective item check sheet:

This check sheet is intended to specify the variety of defects occurring, together with their frequency of occurrence.

Defect location check sheet:

This check sheet is intended to identify where defects occur on the product.

Defect factor check sheet:

This check sheet is used to monitor the input parameters in a process that might affect the incidence of defects.

Illustration

Example Fig illustrates the check sheet of customer complaints by category

Check sheet / Tally sheet of customer complaints

S.No	Problems						Frequency
i)	Delivery	𝍸 | |	| |				7
ii)	Packaging	| |					2
iii)	Quality / Performance	𝍸 | |	𝍸 |	|			11
iv)	Personnel	𝍸 | |	𝍸 |				10
v)	Invoicing	𝍸 | |	𝍸 |	𝍸 |	| | |		18

8 **Explain in seven traditional quality tools with suitable examples. / Explain any three new management tools. (April, 2014)(May /June 2016) (Nov/Dec2016)**

Statistical process control (SPC) or Seven traditional quality tools is the application of statistical methods to the monitoring and control of a process to ensure that it operates at its full potential to produce conforming product. Under SPC, a process behaves predictably to produce as much conforming product as possible with the least possible waste.

Seven Tools:

- Pareto Diagram
- Process Flow Diagram
- Cause and Effect diagram
- Check sheets
- Histogram
- Scatter diagram
- Control charts

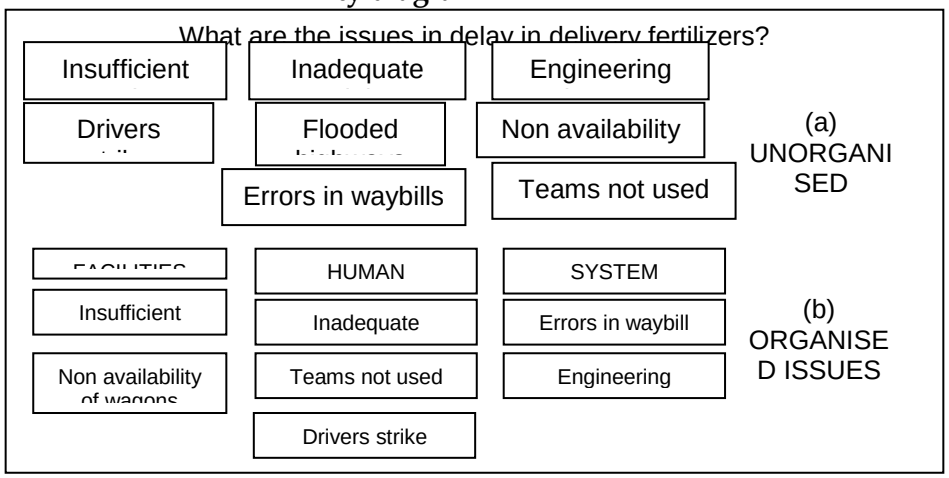
NEW MANAGEMENT AND PLANNING TOOLS

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.

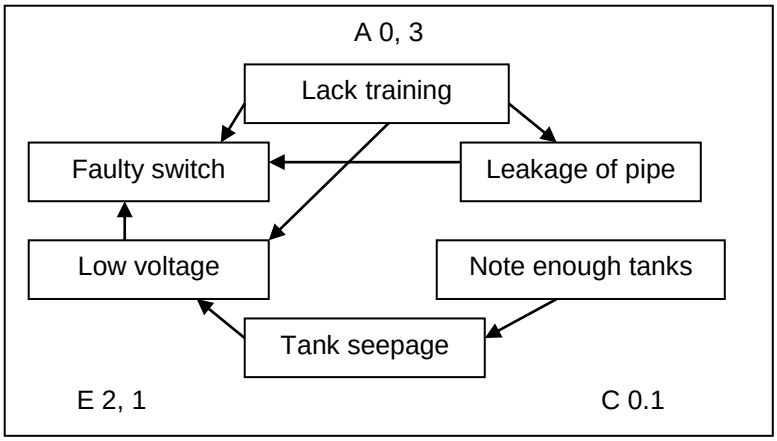
Second iteration is to compare B with issues C, D, E and F. The third step is to compare C

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.

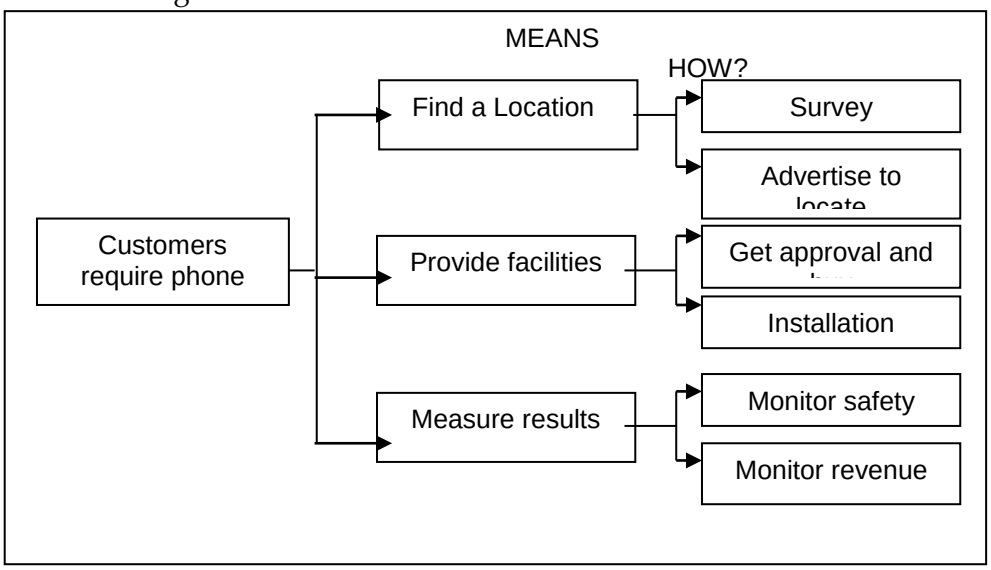


Interrelationship diagram

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.



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

Options	CRITERIA: 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 truck	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 & acceptance	Registration	Conduct Proceedings		Boarding & 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.

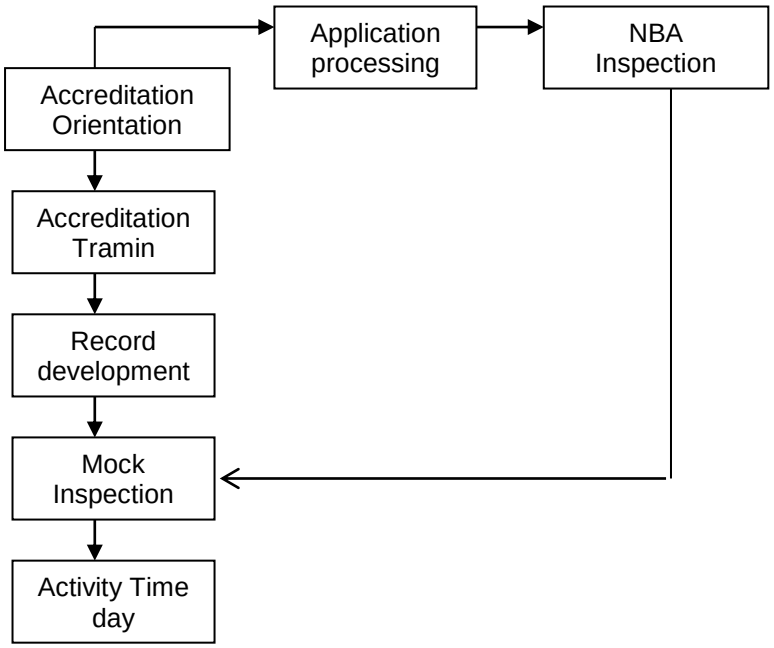
This method is preferred if the task is new or unique, complex, or potential failure has great risks. It provides a means to effectively minimize uncertainty in implementation stage.

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.



Activity 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.

9 **Explain the failure mode and effect analysis (FMEA). (Nov/Dec2016)**

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

Objectives of FEMA:

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

Types of FEMA:

1. System FEMA
2. Design FEMA
3. Process FEMA
4. Service FEMA
5. Equipment FEMA
6. Maintenance FEMA
7. Concept FEMA

8. Environmental FEMA

Benefits of FEMA:

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

Meaning of reliability:

Reliability is one of the most important characteristics of any product, no matter what its application. Reliability is also an important aspect when dealing with customer satisfaction. Whether the customer is internal or external. Customers want a product that will have a relatively long service life, with long times between failures. However, as products become more complex in nature, traditional design methods are not adequate for ensuring low rates of failure. This problem gave rise to the concept of designing reliability into the product itself.

Reliability requirements:

The acceptance of a certain product or process is subject to meeting certain set of given requirements for reliability of the product or process. It is however important to realize that although the definition for reliability is relatively simple, the customer and the supplier may have different definitions of what failure constitute. This common agreement on what constitutes reliability should be defined in terms of influence on other related systems, the complexity of the failure, and finally the relative criticality of the failure.

Failure rate:

A vast majority of products follow a very familiar pattern of failure. When no information is known about the reliability or conversely, failure of a product, component, system or process, except the failure rate which is a constant, periods of failure can conveniently be modeled by an exponential distribution. The failures of most products can be classified in to three main categories: debug, chance, and wear out. The first of these includes a high failure rate at the initial stages because of inappropriate use or flaws in the design or manufacturing. The next category is the failure of the product due to accidents, poor maintenance, or limitations on the design. The final category covers failure after the product or process has performed as expected for at least the amount of time given by the manufacturer as the product or process life. A successful design or process ideally fails only in this method.

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 cause.
    d. risk priority number.
3. Correcting high risk causes
    A. prioritizing work
    B. detailing action
    C. assigning action responsibility.

D. checks points on completion.

4. Re-evaluation of risk

A. 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

10 **What is bench marking? Explain its Types.**

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."

THORE defines benchmarking as "the systematic comparison of elements of performance of an organization against those of other organizations, usually with the aim of mutual improvement."

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:

1. Product Benchmarking: this refers to comparison of different features and attributes of competing products and services.
2. 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.

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

4. 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

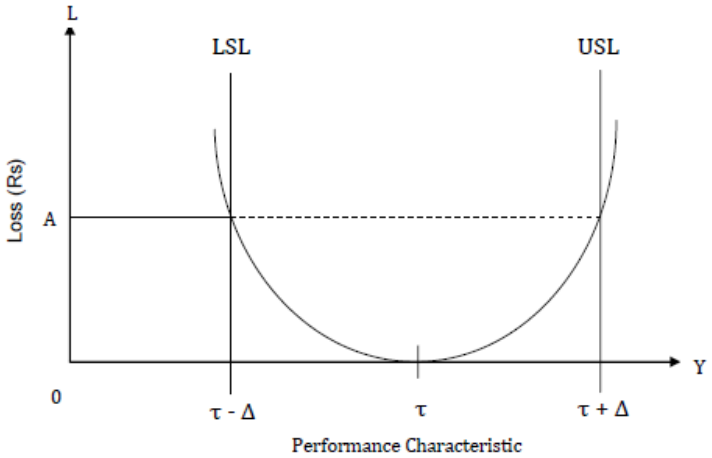
	Phase 5: **Maturity:** Step 11: Attain the leadership position. Step 12: Integrate practices into the process. **Benefits of benchmarking**: a. . Creating a culture that values continuous improvement to achieve excellence. b. . Sharing the best practices between benchmarking partners. c. . Prioritizing 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.
11	**What benefits have been achieved by the Organization that have been successfully completed their benchmarking programs ?Name any four best practiced companies. (Nov/Dec2016)** **Benefits of benchmarking**: 1. . Creating a culture that values continuous improvement to achieve excellence. 2. . Sharing the best practices between benchmarking partners. 3. . Prioritizing the areas that need improvement. 4. . Enhancing creativity by devaluing the not invented here syndrome 5. . Increasing sensitivity to changes in the external environment. 6. .Shifting the corporate mindset from relative complacency to a strong sense of urgency for ongoing improvement. .Focusing resources through performance target set with employee unit. **Four Best Practiced Companies** **Microsoft, Marriott International, Southwest Airlines, Intel**
12	**Why bench marking is required in an organization?IIlustrate the different types of bench marking process.Write down the general procedure for bench marking process.** A measurement of the quality of an organization's policies, products, programs, strategies, etc., and their comparison with standard measurements, or similar measurements of its peers. **Objectives of benchmarking**: Benchmarking aims at a goal setting process to facilitate comparison with the best. It aims at motivating and stimulating company employees towards the goal of continuous quality improvement. It aims at external orientation of the company It aims at identifying a technological breakthrough It aims at searching for industry best practices. **Types of Benchmarking:** **Classification based on the object to be benchmarked:** **1. Product Benchmarking**: comparison of different features and attributes of competing products

	and services. **2. Performance Benchmarking**: comparison of performance indicators related to a business as a whole or to the group of critical activities or processes. **3. Process Benchmarking**: comparison of processes. It identifies a more effective and efficient process to be implemented. **4. Strategic Benchmarking**: 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: Phase 2: Analysis: Phase 3: Integration: Phase 4: Action Phase 5: Maturity:
13	List out the different situations where FMEA is to be carried out. Give detailed FMEA procedure. ***(April/May2017)*** 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:** 5. The objective of FMEA is to anticipate failures and prevent them from occurring. FEMA prioritizes failures and attempts to eliminate their causes. 6. 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. 7. FMEA is a before the event action and is done when existing systems products processes are changed or redesigned. 8. FMEA is a never ending process improvement tool. **Types of FMEA:** 9. System FMEA 10. Design FMEA 11. Process FMEA 12. Service FMEA 13. Equipment FMEA 14. Maintenance FMEA 15. Concept FMEA Environmental FMEA **Benefits of FMEA:** 10. Improve product/process reliability and quality. 11. Increase customer satisfaction. 12. Early identification and elimination of potential product/process failure modes. 13. Prioritize product or process deficiencies 14. Capture engineering/organization knowledge 15. Document and track the actions taken to reduce risk 16. Provide focus for improved testing and development. 17. Minimize late changes and associated cost.

	18. Act as catalyst for teamwork and idea exchange between functions. **STAGES OF FMEA:** 1. Specifying possibilities 2. Quantifying risk 3. Correcting high risk causes 4. Re-evaluation of risk
UNIT IV-TQM TOOLS AND TECHNIQUES **Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.**	
PART-A	
1	**List the objectives of TPM programme.** The overall goals of TPM are: Maintaining and improving equipment capacity. Maintaining equipment for life. Using support from all areas of operation. Encouraging inputs from all employees. Using teams for continuous improvement.
2	**What is Product Life Characteristics Curve?** The failure rate curve, called the *product life characteristics curve,* shows the failure rates (failures per unit time) against time. It is also called as *bathtub curve* because of its shape.
3	**What are the three stages shown on a Product Life Characteristics Curve?** The curve consists of three distinct stages: Early failure ('infant mortality' or 'debug'), useful life ('normal failure' or 'chance') and wear out ('old age') failure. The curve shows that the failure rates are higher at the early and end stages of a product's life and relatively low in between the two extremes.
4	**What is the usefulness of the Product Life Characteristics Curve?** Knowing the product life characteristics curve for a particular product helps engineers predict failure behavior and take suitable decisions.
5	**What is the essential feature of Total Productive Maintenance (TPM)?** TPM is keeping plant and equipment at their highest productive level through cooperation of all areas of the enterprise. TPM brings maintenance into focus as a necessary and vital part of the business. It is not regarded as a non-profit activity. Down time for maintenance is scheduled as an integral part of the manufacturing process.
6	**What are the various approaches to improving reliability of a product?** Standardization, redundancy, over-design, de-rating, design simplification, understanding the physics of failure, burn-in, and Failure Mode and Effect Analysis (FMEA).
7	**What are the different ways of classifying maintenance activities?** Maintenance activities can be classified in various ways: 1.Planned (or preventive) maintenance vs. Unplanned (or breakdown) maintenance 2.Preventive maintenance can be sub-classified into Periodic maintenance and Predictive maintenance 3.Running maintenance vs. Shutdown maintenance 4.Time-based maintenance vs. Condition-based maintenance
8	**What is some performance measures used to assess the success of TPM?** Mean Time Between Failures (MTBF), Mean Time To Repair (MTTR), Availability (A), Reliability (R), Maintainability (M), Rate efficiency (RE), Speed efficiency (SE), Performance efficiency (PE), Quality rate (Q), and Overall Equipment Efficiency (OEE).
9	**What are the three categories of losses identified in TPM?** 1.Losses that impede equipment efficiency,2. Losses that impede human work efficiency and 3.Losses that impede effective use of production resources.
10	**What are the eight pillars of TPM?**

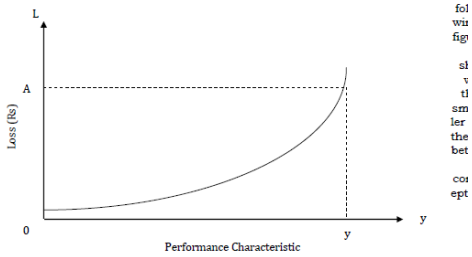
	The eight pillars of TPM are: 1. 5S 2. Jishu Hozen (Autonomous Maintenance) 3. Kobetsu Kaizen (KK) 4. Planned Maintenance (PM) 5. Quality Maintenance (QM) 6. Training 7. Office TPM and 8. Safety, Health and Environment.
11	**What is Office TPM?** Office TPM is aimed at improving quality, productivity and efficiency in the administrative functions and identifying and eliminating losses.
12	**What is Business Process Reengineering (BPR)?** The fundamental rethinking and radical redesign of business processes to improve performance dramatically in terms of measures like cost, quality, service, and speed.
13	**What are some key requirements for success in BPR implementation?** The key requirements for success in BPR are: 1.Fundamental understanding of processes 2.Creative thinking, and 3. Effective use of information technology.
14	**Distinguish between Kaizen and BPR.** Kaizen involves incremental improvements, whereas BPR involves breakthrough improvements. Both are essential for successful implementation of TQM.
15	**What are the seven principles of reengineering?** 1. Organize around outcomes, not tasks 2. Those who use the output of the process must perform the process 3. Merge information processing work into the real work that produces the information, 4. Treat geographically dispersed resources as though they are centralized 5. Link parallel activities instead of integrating their results 6. Put the decision point where the work is performed, and 7. Capture information once – at the source.
16	**Mention the major steps in BPR implementation.** 1. Develop business vision and process objectives. 2. Study the existing procedures. 3. Identify the process for reengineering. 4. Identify customer requirements. 5. Understand the current process. 6. Identify gaps between current process and customer requirements. 7. Evaluate enablers (organizational issues, information technology). 8. Develop improved process. 9. Develop action plan for implementation. 10. Implement the reengineered process. 11. Follow up
17	**What is quality loss?** This loss includes costs to operate, failure to function, maintenance and repair costs, customer dissatisfaction injuries caused by poor design and similar costs.
18	**Mention some major benefits of BPR.** 1. Better financial performance

	2. Enhanced customer satisfaction 3. Cost reduction 4. Better product/service quality 5. Increase in productivity 6. Improved flexibility / responsiveness 7. Reduced process times 8. Improved employee participation 9. Increased competitiveness 10. Improved delivery performance.
19	**Mention some major limitations of BPR.** Reengineering involves a great deal of risk. Some major limitations of BPR are: 1.BPR is strong medicine, often resulting in massive layoffs, 2.It could cause disruptions in existing jobs, management systems, and organizational structures 3.It often involves large investments, especially in I.T 4. BPR cannot succeed in organizational cultures which are resistant to change, and 5.BPR is not simple or easily done, nor is it appropriate for all processes and for all organizations
20	**What is QFD?** 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.
21	**What is control chart and types of control charts?** A control chart is a graph that displays data taken over time and the variation of this data. Control charts for variables – for measurable data such as time, length, temperature, weight, pressure, etc. Control charts for characteristics- for quantifiable data such as number of defects, typing errors in a report, etc.
22	**When do you use control chart?** The purpose of control chart is to identify when the process has gone out of statistical control, thus signaling the need for some corrective action to be taken.
23	**What are some factors affecting the success of BPR implementation?** (i) Critical/core processes (ii) Strong leadership (iii)Cross-functional teams (iv) Information technology (v)'Clean slate' philosophy and (vi) Process analysis.
24	**What are the performance measures of TQM?** Customer orientation, value based operations, performance compatibility, teamwork, development monitoring
25	**What is meant by process capability? (May /June 2016)** Process capability may be defined as the "minimum spread of a specific measurement variation which will include 99.7% of the measurements from the given process". Process capability=6σ.Since 99.7% area in the normal curve is between -3σ and +3σ.
26	**What are the benefits of TPM?(or) List out the benefits of total productive maintenance *(May /June 2016) .(April/May2017)*** Increased equipment productivity, Improvement equipment reliability, Reduced equipment downtime, Increased plant capacity, Extended machine time, Lower maintenance and production costs, Approaching zero equipment-caused defects, Improved team work between operators and maintenance people, Enhanced job satisfaction, Improved return on investment,

	Improved safety.
27	**Define process capability index. (Nov/Dec2016)** The process capability index or process capability ratio is a statistical measure of process capability: the ability of a process to produce output within specification limits. The concept of process capability only holds meaning for processes that are in a state of statistical control. Process capability indices measure how much "natural variation" a process experiences relative to its specification limits and allows different processes to be compared with respect to how well an organization controls them.
28.	**Write down the various stages of FMEA. (May /June 2016)** The FMEA methodology has four stages. Stage1:Specifyinf possibilities. Stage2:Quantifying risk Stage3:Correcting high risk causes. Stage4:Re-evaluatiom of risks.
	PART-B
1	**Explain about TAGUCHI'S quadratic QUALITY LOSS FUNCTION. How it differs from traditional approach of quality loss cost? (June, 2013); (MAY/JUNE 2009)** Taguchi‟s Quality Loss Function concept combines cost, target and variation in one metric with specifications being of secondary importance. 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 ideal performance and harmful side effects. **CUSTOMERS PERCEIVE QUALITY AS MEETING THE TARGET RATHER THAN JUST MEETING THE SPECIFICATIONS.** There are three common quality loss functions 1. Nominal - the - best. 2. Smaller - the - better. 3. Larger - the - better. **NOMINAL – THE – BEST :** Although Taguchi developed so many loss functions, many situations are approximated by the quadratic function which is called the **Nominal – the – best** type.  The quadratic function is shown in figure. In this situation, the loss occurs as soon as the

performance characteristic, y, departs from the target τ.
At τ, the loss is Rs. 0.
At LSL (or) USL, the loss is Rs. A.
The quadratic loss function is described by the equation L = k (y - τ) 2.
Where,
L = cost incurred as quality deviates from the target.
y = Performance characteristic
τ = target
k = Quality loss coefficient.

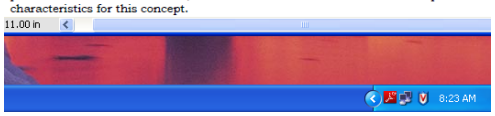
The loss coefficient is determined by setting Δ = (y – τ), the deviation from the target. When Δ is the USL (or) LSL, the loss to the customer of repairing (or) discarding the product is Rs. A.
Thus,
K = A / (y – τ)2 = A / Δ2 .



Smaller-the-better

value for **smaller – the – better** is 0. There are no negative values for the performan characteristic.

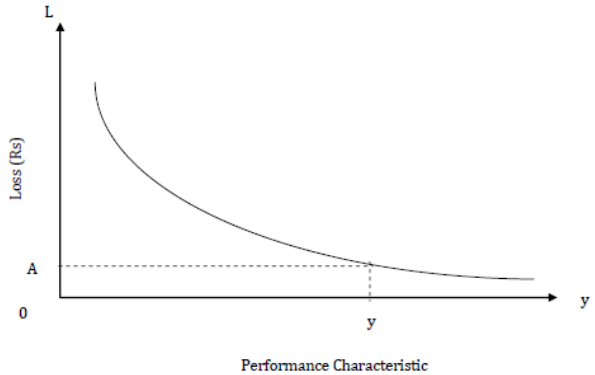
The radiation leakage from a microwave appliance, the response time for a compute pollution from an automobile, out of round for a hole etc. are the performan characteristics for this concept.



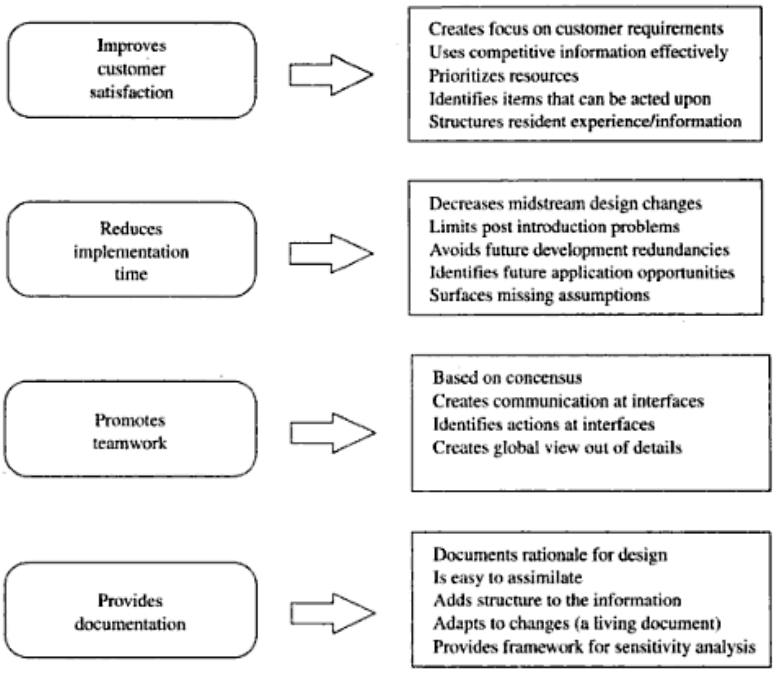
The target value for **smaller – the – better** is 0. There are no negative values for the performance characteristic.
The radiation leakage from a microwave appliance, the response time for a computer, pollution from an automobile, out of round for a hole etc. are the performance characteristics for this concept.

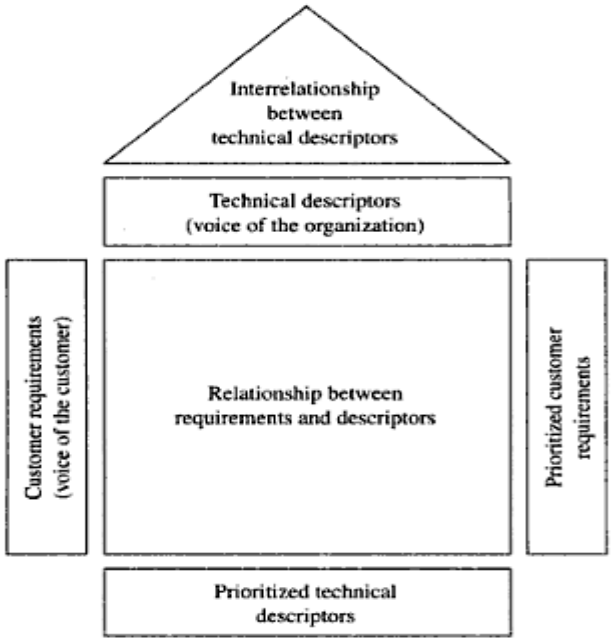
LARGER – THE – BETTER :

The following figure shows the concept of the Larger – the – better.



Performance Characteristic

	In the Larger – the – better concept, the target value is ∞ (infinity), which gives a **zero loss**. There are no negative values and the worst case is at y = 0. Actually, larger – the – better is the reciprocal of smaller – the – better. The performance characteristics in Larger – the – better are bond strength of adhesives, welding strength etc.
2	**Highlight the benefits of QFD. (Apr /May 2010). (Nov/Dec2016)** **BENEFITS OF QFD:**  **Benefits of QFD**
3	**Briefly explain the steps involved in QFD (NOV/DEC 2010)(May /June 2016)** **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.
4	**Explain each section of the basic structures of house of quality. (APR/MAY 2010)/ Explain in detail about the structure of house of quality. (April, 2014)) (Nov/Dec2016)** **HOUSE OF QUALITY:** The primary planning tool used in QFD is the house of quality. The house of quality converts the voice of the customer into product design characteristics. QFD uses a series of matrix diagrams, also called 'quality tables', resembles connected houses. **Basic structure of house of quality:** 1. Customer requirements 2. Prioritized customer requirements 3. Technical descriptors 4. Relationship matrix 5. prioritized technical descriptors 6. Competitive assessments 7. Develop a relationship matrix between WHATS AND HOWS  **House of** QUALITY **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
5	**Discuss objectives of quality function deployment.** Quality function deployment is a systematic and organized approach of taking customer needs and demands into consideration while designing new products and services or while improving the existing products and services. **Definition:** Quality function deployment may be defined as a system for translating consumer requirements into appropriate requirements at every stage, from research through product design and development, to manufacture, distribution, installation and marketing, sales and service.

OBJECTIVES OF QFD:

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

6 **Give detailed notes about quality circle.**

Quality Circles are usually characterized as small, voluntary groups of employees set up to meet periodically for such practical purposes as:

- Pinpointing, examining, analyzing and solving problems in areas including knowledge management, innovation, work relations, quality, productivity, safety, cost, etc.
- Enhancing communication between employees and management on the above areas

Quality

Circles can only thrive if management will take action on the recommendations of the Circle. When the management has no interest in participation as is often the case, the Circles simply disintegrate.

uality Circles are successful when they:

- are part of an entire system focusing on organisational improvement which includes strong

management commitment

- are supported by other Quality Circles in other organisational departments
- have employee input
- are part of a long-term plan for continuous improvement,
- are supported through education for employees and subcontractors
- have a strong customer orientation.

The small business owner must be willing and able to commit the time and resources needed to train the employees who will participate in the programme, particularly the quality circle leaders and facilitators. It may even be necessary to hire outside facilitators if the time and expertise does not exist in-house.

Small business owner must also allow time for the quality circles to begin achieving desired results; in some cases, it can take more than a year for expectations to be met.

Successful quality circles offer a wide variety of benefits for small businesses. E.g. they serve to increase management's awareness of employee knowledge and ideas, as well as employee awareness of the need for knowledge sharing and innovation within the company. Quality circles also serve to facilitate communication and increase commitment among both labour and management.

In enhancing employee satisfaction through participation in decision-making, such initiatives may also improve a small business's ability to recruit and retain qualified employees.

In addition, many companies find that quality circles further teamwork and reduce employee resistance to change.

Finally, quality circles can improve a small business's overall competitiveness by making best use on explicit and tacit knowledge, reducing costs, improving quality, and promoting innovation.

In most quality circle programmes there are no direct financial rewards for coming up with good ideas or cost savings.

Quality circles normally meet on a regular basis, often at two-week intervals, for perhaps one or two hours.

7 **Explain about structure of quality circle and quality circle tools.**

Structure of quality circle

- A steering committee: This is at the top of the structure. It is headed by a senior executive and includes representatives from the top management personnel and human resources development people. It establishes policy, plans and directs the program and meets usually once in a month.
- Co-ordinator: He may be a Personnel or Administrative officer who co-ordinates and supervises the work of the facilitators
- Facilitator: He may be a senior supervisory officer. He co-ordiates the works of several quality circles through the Circle leaders.
- Circle leader: Leaders may be from lowest level workers or Supervisors. A Circle leader organises and conducts Circle activities.
- Circle members : They may be staff workers. Without circle members the porgramme cannot exist. They are the lifeblood of quality circles.

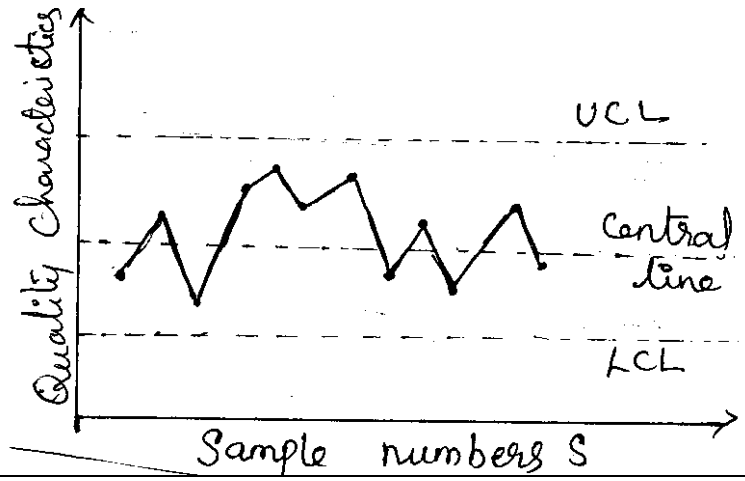
Quality Circle Tools

- Ishikawa Diagram - shows hierarchies of causes contributing to a problem
- Pareto Chart - analyses different causes by frequency to illustrate the vital cause
- PDCA-Deming wheel - Plan, Do, Check, Act, as described by W. Edwards Deming

8 **Explain control chart (or) Shewhart chart./ Explain with an example of any three control charts. (May /June 2016) (Nov/Dec2016)**

What is it?

- ***A control chart,*** invented by Walter A. Shewhart, is the most widely used tool in statistical process control (SPC).
- A control chart is a graph that displays data taken over time and the variations of this data.
- A histogram gives a static picture of process variability, whereas a control chart illustrates the dynamic performance (i.e., performance over time) of the process.
- The control chart is based on a series of random samples taken at regular intervals.
- The general form of the control chart is shown in Fig. 6.11.



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

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

Type of Control Charts

The two basic types of control charts are:

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

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

When do we use it?

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

9 **Compare the variable charts and Attribute charts.**

Comparison of three types of control charts

Statistical measure plotted	Average $\bar{X}$ and range R	Percentage non-conforming (p)	Number of non-conformities (c)
Types of data required	Variable data (measured values of a characteristic)	Attribute data (Number of defective units of product)	Attribute data (number of defects per unit of product)
General field of application	Control of individual characteristics	Control of overall fraction defective of a process	Control of overall number of defects per unit
Significant advantages	Provides maximum utilization of information available from data Provides detailed information on process average and variations for control of individual dimensions	Data required are often already available from inspection records. Easily understood by all personnel. Provides an overall picture of quality.	Same advantages as p-chart but also provides a measure of defectiveness.
Significant disadvantages	Not understood unless training is provided, can cause confusion between control limits and tolerance limits. Cannot be used with go/no go type of data.	Does not provide detailed information for control of individual characteristics. Does not recognize different degrees of defectiveness in units of product.	Does not provide detailed information for control of individual characteristics.
Sample size	Usually 4 or 5	Uses given inspection results for samples of 25, 50 or 100	Any convenient unit of product such as 50 m of wire or one computer set.

10 **Explain Total Productive Maintenance (TPM) with case study.**

What is Total Productive Maintenance (TPM) ?

It can be considered as the medical science of machines. Total Productive Maintenance (TPM) is a maintenance program which involves a newly defined concept for maintaining plants and equipment. The goal of the TPM program is to markedly increase production while, at the same time, increasing employee morale and job satisfaction.

TPM brings maintenance into focus as a necessary and vitally important part of the business. It is no longer regarded as a non-profit activity. Down time for maintenance is scheduled as a part of the manufacturing day and, in some cases, as an integral part of the manufacturing process. The goal is to hold emergency and unscheduled maintenance to a minimum.

Why TPM ?

TPM was introduced to achieve the following objectives. The important ones are listed below.

- Avoid wastage in a quickly changing economic environment.
- Producing goods without reducing product quality.
- Reduce cost.
- Produce a low batch quantity at the earliest possible time.
- Goods send to the customers must be non defective.Types of maintenance : Breakdown maintenance :
- 2. Preventive maintenance (1951):

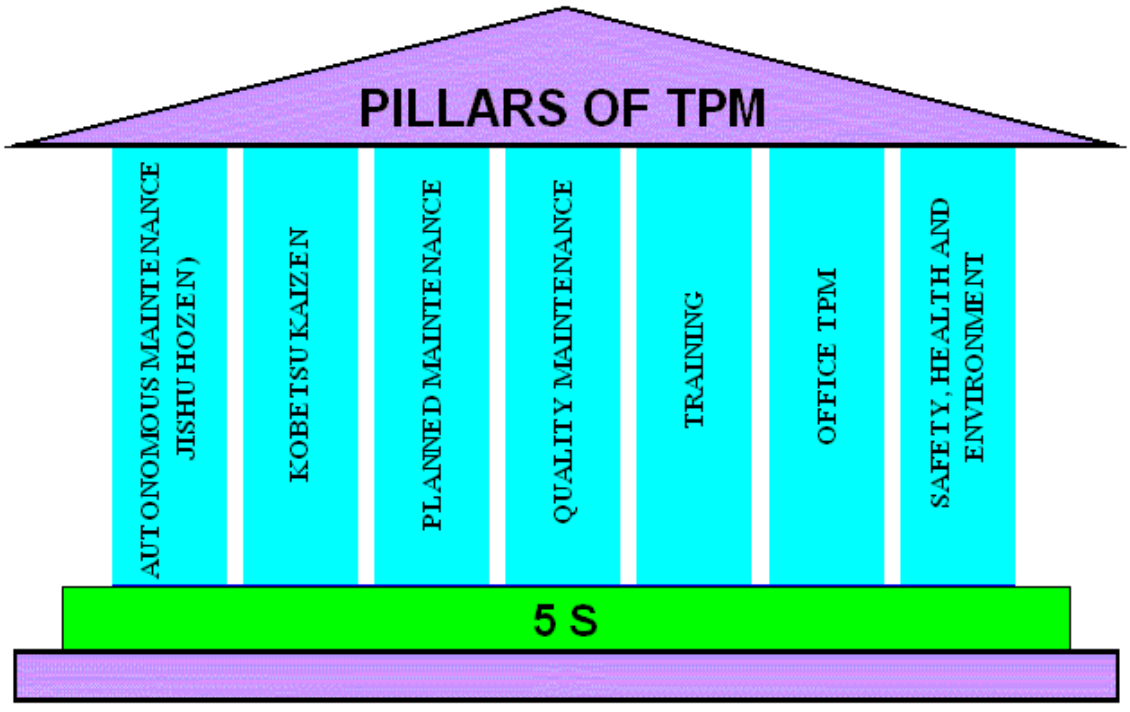
2a. Periodic maintenance (Time based maintenance - TBM) :

2b. Predictive maintenance :

3. Corrective maintenance (1957) :

4. Maintenance prevention (1960):

Pillars of TPM



The TPM concept was first introduced by M/s Nippon Denso Co. Ltd. of Japan, a supplier of M/s Toyota Motor Company, Japan in the year 1971. Total productive maintenance is an innovative approach to maintenance that optimizes equipment effectiveness, eliminates breakdowns and promotes autonomous maintenance by operators through day-to-day activities involving total workforce.

The manufacturing industry has experienced an unprecedented degree of change in the last three decades, involving drastic changes in management approaches, product and process technologies, customer expectations, supplier attitudes as well as competitive behavior. In today's fast - changing marketplace, slow, steady improvements in manufacturing operations do not guarantee sustained profitability or survival of an organization. Thus the organizations need to improve at a faster rate than their competitors, if they are to become or remain leaders in the industry. A survey of manufacturers found that full-time maintenance personnel as a percentage of plant employees averaged 15.7 percent of overall staffing in a study involving manufacturing organizations, whereas in refineries, the maintenance and operations departments are often the largest and each may comprise about 30 percent of total staffing. It has been found that in the UK manufacturing industry, maintenance spending accounts for a significant 12 to 23 percent of the total factory operating costs. With sobering figures like these, manufacturers are beginning to realize that maintenance organization and management, and design for maintainability and reliability are strategic factors for success in 1990s. Thus the effectiveness of maintenance function significantly contributes towards the performance of equipment, production and products.

11 Perform an FMEA to anticipate various problem faced and method to eliminate the problem of getting up from bed in the morning and going to school. ***(May /June 2016)***

Process	Potential Failure Mode	Potential Failure Effects	Severity	Potential Causes	Occurrence	Current Controls	Detection	RPN
Waking up	Sleep through alarm	Late to work	5	Tired in morning	4	Single alarm clock	5	100
Eat Breakfast	No food in the house	Distracted & not as productive at work	5	Did not grocery shop	3	Occasionally grocery shop	5	75
Transportation	Car won't start	Late to work	7	Various part issues	3	Car warning senors	4	84

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:

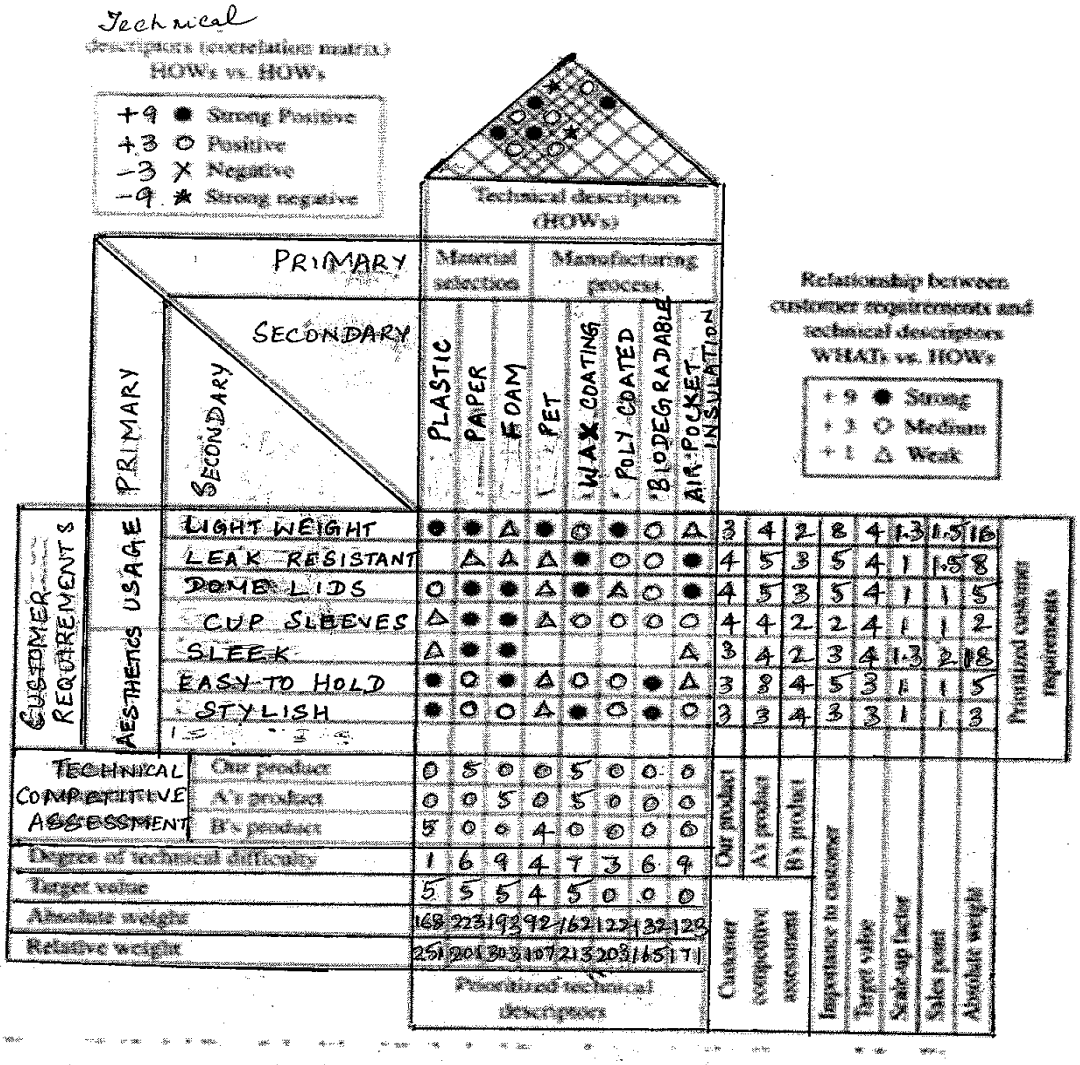
1. System FMEA
2. Design FMEA
3. Process FMEA
4. Service FMEA
5. Equipment FMEA
6. Maintenance FMEA

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.

12 **Devise a QFD methodology for design and development of cups used in vending machine for dispersing hot and cold beverages***(May /June 2016)*



13 **Write down the objectives of implementing total productive maintenance. Discuss about the core elements of TPM program. Compare TQM and TPM.(*April/May2017*)**

TPM brings maintenance into focus as a necessary and vitally important part of the business. It is no longer regarded as a non-profit activity. Down time for maintenance is scheduled as a part of the manufacturing day and, in some cases, as an integral part of the manufacturing process. The goal is to hold emergency and unscheduled maintenance to a minimum.

The overall goals of TPM are: Maintaining and improving equipment capacity. Maintaining

equipment for life. Using support from all areas of operation. Encouraging inputs from all employees. Using teams for continuous improvement

There are five core elements to a TPM program:

1.Operator Self-Maintenance
2.Conduct Planned Maintenance
3.Small Group Kaizen Activities
4.Education and Training
5.Maintenance Prevention.

Compare TQM and TPM

TQM	TPM
1. It describes a management approach to long–term success through customer satisfaction. In a TQM effort, all members of an organization participate in improving processes, products, services, and the culture in which they work.	It is a system of maintaining and improving the integrity of production and quality systems through the machines, equipment, processes, and employees that add an business value to an organization.
2. TQM target is quality for PPM	TPM target is elimination of losses and wastes
3.GOALS OF TQM: ✓ TQM works by continuously improving all aspect of work through structured control, improvement and planning activities that are carried out in concern with guiding ideology that focuses on Quality and Customer Satisfaction as the top priorities.	GOALS OF TPM: ✓ Zero breakdowns, zero accidents, and zero defects performance, safety, and quality. ✓ Promote TPM through motivational management. ✓ Maintains and improves equipment capacity. ✓ Maintains equipment for life. ✓ Uses support from all areas of the operation. ✓ Encourages input from all employees. ✓ Uses teams for continuous improvement.

14 **(i) List out the benefits of performance measure. *(April/May2017)***

1. Planning and meeting established operating goals and standards.
2. Detecting deviations from planned level of performance.
3. Restoring performance to the planned levels or achieving new level of performance.
4. To Identify whether company meet the customer requirements.
5. To Identify whether supplier meet the company requirements.
6. It help us to understand the company's processes

(ii) Briefly explain the DMAIC procedure.

The five phases in six sigma process are:

1. Define the problem, improvement activity, opportunity for improvement, the project goals, and customer (internal and external) requirements.

2. **Measure** process performance.

3. **Analyze** the process to determine root causes of variation, poor performance (defects).

4. **Improve** process performance by addressing and eliminating the root causes.

5. **Control** the improved process and future process performance.

UNIT V- QUALITY SYSTEMS

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

PART-A

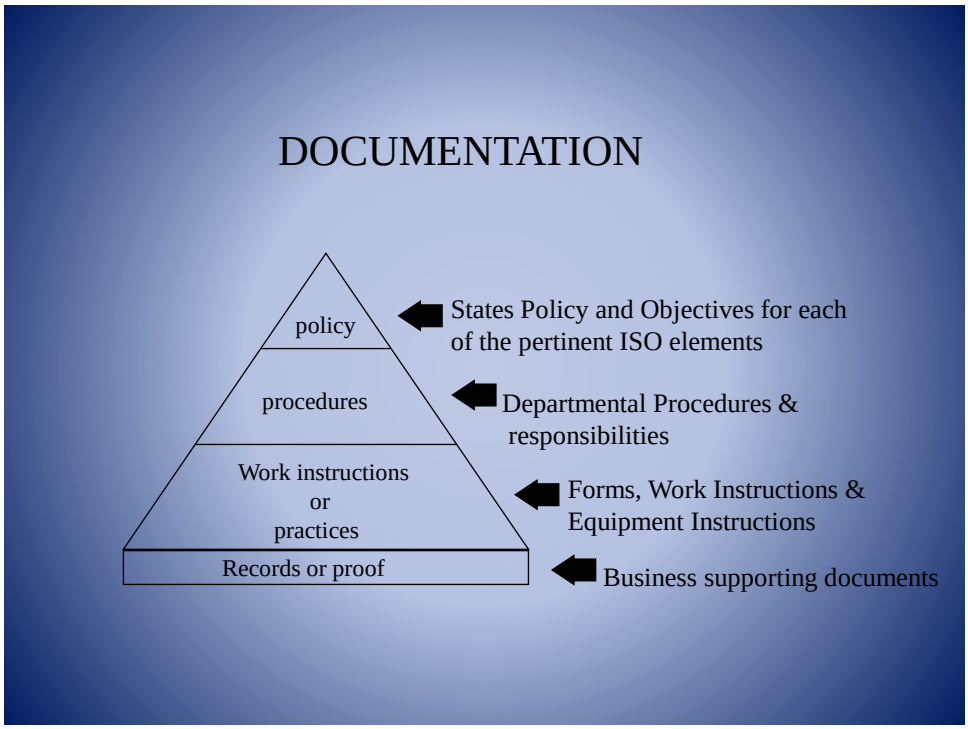
1	**What is the concept of Environment Management Systems?** 1.An EMS meeting the requirements of ISO 14001:2004 is a management tool enabling an organization of any size or type to: 2.Identify and control the environmental impact of its activities, products or services, and to 3.Improve its environmental performance continually, and to 4.Implement a systematic approach to setting environmental objectives and targets,to achieving these and to demonstrating that they have been achieved
2	**What are ISO 9000 quality standards?** ISO 9000 are a set of quality standards aimed at promoting the growth of international trade by facilitating harmonious interactions between suppliers and customers located in diverse locations globally. It is a quality management system [QMS] to ensure quality of products and services.
3	**Write about documentation pyramid.** **Tier 1 - The Quality Manual** The top tier is the quality manual, which contains: • Statements about management's commitment to quality • Quality Policies • Information about responsibilities for quality related processes • It should also contain a list of tier-2 quality documents and how to locate them. • The manual also may contain high-level information about key areas of the quality system like documentation and design control. **Tier 2 - Procedures and Instructions** Tier-2 of the ISO 9001:2008 Documentation pyramid is the bulk of the quality procedures, standard operating procedures (SOPs), work instructions and explains detailed responsibilities for process control. **Tier 3 - Quality Records** Tier-3 consists of quality records. Most of the quality records are generated based on tier-2 procedures. Quality records include customer specifications, order processing paperwork or records, incoming inspection records, and product test results
4	**Define Quality Management Systems.** Quality management systems are the organizational structures, responsibilities, processes, procedures, and resources used for implementing quality.
5	**What are the quality function needs served by the computer?** 1. Data collection 2. Data analysis and reporting 3. Statistical analysis 4. Process control 5. Test and inspection and 6. System design
6	**What are the different types of documents found in ISO 9000?** 1.Quality Policy Manual (What? Why?) 2. Quality System Procedures (Who? When? Where?) 3. Work Instructions (How?) 4. Records, formats, forms (Evidence)

7	**What are the eight quality principles underlying ISO 9000: 2000?** 1.Customer focus 2.Leadership 3.Involvement of people 4.Process approach 5.System approach to management 6.Continuous improvement 7.Decisions based on facts and 8. Mutually beneficial supplier relationships.
8	**Define quality system audit.** Quality system audits is a systematic, independent examination to determine whether quality activities and results comply with planned arrangements, whether these arrangements are implemented effectively, and whether these are suitable to achieve objectives.
9	**What are the different types of audit?** First party audit (internal), Second party audit (by customer), and Third party audit (by independent agency). Another classification: System audit, Process audit, Product audit, Adequacy audit, and Compliance audit
10	**What are the different stages in conducting quality audit?** 1.Audit planning – schedules, personnel, notifications, checklist. 2. Performance – opening meetings, audit process, noting of non-conformities. 3. Reporting – Observations, suggestions for corrective action 4. Follow-up – implementation of corrective action.
11	**Give any five elements of ISO 9000.** 1.Management responsibility 2.Quality system 3.Contract review 4.Design control 5.Document control 6.Purchasing 7.Purchaser supplied product 8. Product identification and traceability 9.Process control 10.Inspection & testing
12	**Give the objectives of internal audit.** 1. Determine the actual performance conforms to the documented quality systems. 2. Initiate corrective action activities in response to deficiencies. 3. Follow up on noncompliance items of previous audits. 4. Provide continued improvement in the system through feedback to management.
13	**What are the uses of ISO standards?** 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.

14	**Explain the management's responsibility for ISO.** Top management shall provide evidence of its commitment to the development and implementation of the quality management system and continually improving its effectiveness by 1.Communicating to the organization the importance of meeting customer as well as statutory and regulatory 2.Requirements,establishing the quality policy, 3.Ensuring that quality objectives are established, 4.Conducting management reviews, and 5.Ensuring the availability of resources.
15	**What is the need for ISO standards?** 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.
16	**What is third party audit?** The third party certification audit is carried out much in the same way as first party and second party quality system assessments and audits. However, the big difference is that an independent accredited auditing body carries out the assessment and audit, as opposed to carrying it out by the organization themselves. Also note that the organization going for third party audits are responsible for the payment of the third party audit process.
17	**What are the documentation requirements of quality management systems?** The quality management system documentation shall include 1. Documented statements of a quality policy and quality objectives, 2. A quality manual 3. Documented procedures and records required by this International Standard, and 4. Documents, including records, determined by the organization to be necessary to ensure the effective planning, operation and control of its processes.
18	**What are the requirements of ISO 14001?** 1. General requirements 2. Environmental policy 3. Planning 4. Implementation and operation 5.Checking and corrective action and 6.Management review
19	**What are the benefits of ISO 14001?** 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
20	**What are the general requirements of quality management system?** The organization shall establish, document, implement and maintain a quality management system and continually improve its effectiveness in accordance with the requirements of this International Standard. The organization shall a)Determine the processes needed for the quality management system and their application throughout the organization b)Determine the sequence and interaction of these processes, c)Determine criteria and methods needed to ensure that both the operation and control of these processes are effective, d)Ensure the availability of resources and information necessary to support the operation and monitoring of these processes,

	e)Monitor, measure (where applicable), and analyses these processes, and f)Implement actions necessary to achieve planned results and continual improvement of these processes.
21	**What is quality manual?** The organization shall establish and maintain a quality manual that includes 1.The scope of the quality management system, including details of and justification for any exclusions. 2.The documented procedures established for the quality management system, or reference to them, and 3.A description of the interaction between the processes of the quality management syste
22	**Draw the documentation pyramid. (Dec 2011)** 
23	**What are the benefits of ISO 14001?** 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.
24	**Name any two generic ISO standards. Why it is called generic standards? (Nov/Dec2016)** ISO 9001 and ISO 14001 are generic standards. Generic means that the same standards can be applied: 1.To any organization, large or small, whatever its product or service, 2.In any sector of activity, and 3.Whether it is a business enterprise, a public administration, or a government department.
25	**List down the main elements of ISO 14000. (May /June 2016)** 1.Environmental policy 2.Environmental aspects 3.Legal and other requirements 4.Objectives and targets Environmental management program Structure and responsibility 5.Training awareness and competence 6.Communication 7.EMS documentation 8.Document control 9.Operational control Emergency preparedness and response 10.Monitoring and measurement 11.Non-conformances and corrective and preventive.
26	**Write down the benefits of ISO 9000 certification. (May /June 2016)** Increased marketability, Reduced operational expenses, Better management control, Increased customer satisfaction, Improved internal communication, Improved customer service, Reduction of

	product-liability risks and Attractiveness to investors.
27	**What are the core elements of QMS? (Nov/Dec2016)** 1.Quality Policy with quality objectives and KPIs 2.Quality Manual detailing management responsibilities, organizational chart, description of the company and what it does 3.Procedures – overview of specific parts of Nemesis Now operations – e.g. warehousing, sales etc. Should also include procedure for Non-conformities, corrective actions and preventive actions, and control of documents and records 4.Work instructions – detailed description of specific operations, such as completing a quote, invoicing, sales appointment etc. 5.Internal audit – periodic review of the Quality Management System and how it is being implemented, including a review of non-conformities 6.Management review – a review by senior management of the internal audit results and other quality data, including whether the KPIs have been achieved and any tends in data
28	**What are the important requirements of QS9000?*(April/May2017)*** 1.Quality systems assessment guide 2.Advanced product quality planning and control plan reference manual. 3.production part approval process manual. 4.Measurement system analysis reference manual. 5.Fundamental statistical process control reference manual.
29	**Mention the different types of quality audits. *(April/May2017)*** Quality auditing is done by both internal and external bodies. Based on the type of auditor, it is classified as 1.First party audit 2.Second party audit 3.Thrid party audit It is also classified based on the area of coverage as 1.System audit 2.Process audit 3.Product audit.
	PART-B
1	**List and explain the elements of ISO 9000 quality system. (June/May 2013). (April, 2014)** Management responsibility • The Quality system • Contract review • Design control • Document and data control • Purchasing • Control of customer-supplied product • Product identification and traceability • Process control • Inspection and testing • Control of inspection, measuring and test equipment • Inspection and test status • Control of nonconforming product • Corrective and preventive action • Handling, storage, packaging, preservation and delivery • Control of quality records • Internal quality audits • Training

	• Servicing • Statistical techniques
2	**Discuss the benefits of ISO 9000 certification. (June/May 2013)** **ISO 9000** Fewer on-site audit by customers. Increased market share. Improved quality, both internally and externally. Improve product and service quality levels from suppliers. Greater awareness of quality by employees. A documented formal systems. Reduced operating costs.
3	**Explain documentation in quality standard** **Documents** Quality Policy Manual (What?, Why?) Quality System Procedures (Who?, When?, Where?) Work Instructions (how?) Records, Formats, Forms (Evidence) Documentation of quality system • Need : it is understood that the proper documentation is the pre requisite for quality implementation system. • It serves as a reference for management , the staff and the agencies whose involvement is essential for implementation of the quality system Advantages of documentation • Brings about clarity of objectives and targets • Provide standardization in work procedure. • Brings about consistency in operations • Develops confidence amongst employees • Generate customer confidence • Provides basic continuous improvement DOCUMENTATION PYRAMID  POLICY: • This is a document that defines what will be done and why. • A quality policy manual should be written so it is clear, precise, practical, and easy to understand.

PROCEDURE:

- The procedures define
  1) who should perform specific tasks
  2) when the task should be done
  3) Where documentation will be made

showing that the task was performed.

WORK INSTRUCTIONS:

- Work instructions are usually department, machine, task, or product oriented and spell out how a job will be done.
- The writing of a work instruction is best carried out by the employee who performs the task.

RECORDS:

- Records are a way of documenting that the polices, procedures, and work instructions have been followed.
- Records provide data for corrective action and a way of recalling products.

DOCUMENT DEVELOPMENT

- To begin creating the documentation system, the implementation team should gather all the existing policies, procedures, work instructions, and forms that are presently in use.

When the documents have been completed, they should be formatted in a manner that will allow for simple and effective document control.

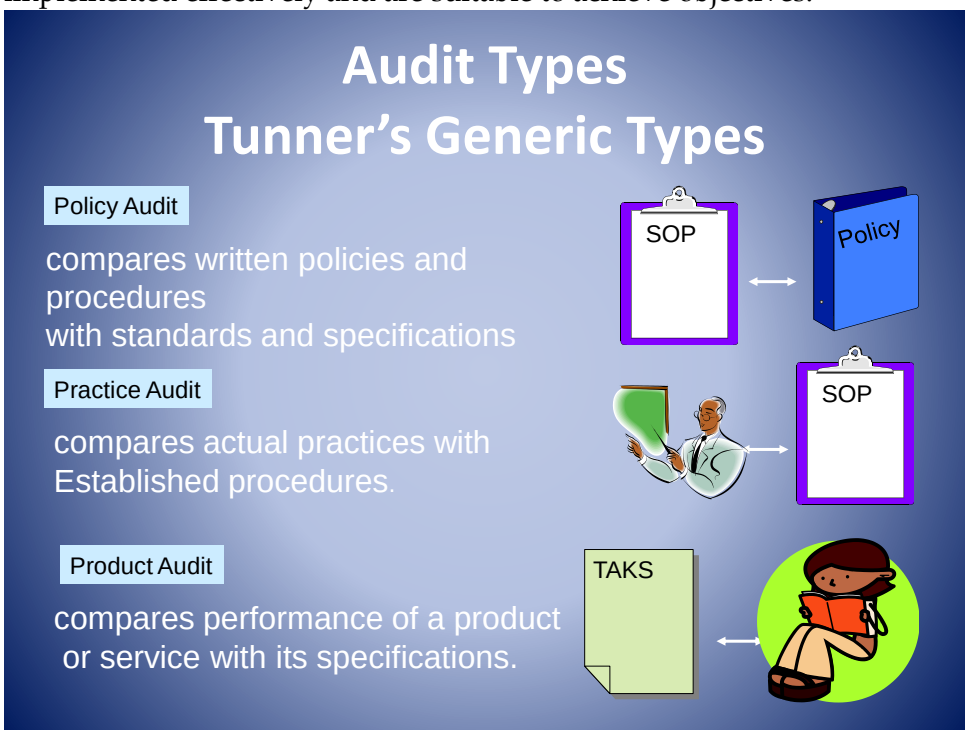
WRITING THE DOCUMENTS

- When writing the document it should be simple rather than complex.
- Use flow chart and check sheets wherever possible rather than lengthy verbiage.

4 **Explain Quality Audits in detail. (Nov/Dec 2011)**

Quality auditing should be carried out in order to verify whether a quality system is effective and suitable.

Definition : A systematic and independent examination to determine whether quality activities and related results comply with planned arrangement , whether these arrangements are implemented effectively and are suitable to achieve objectives.



Audit Types

Arter's Classification

INTERNAL AUDITS

Objectives:

1) Determine that actual performance conforms to the documented QMS.
2) Initiate corrective action activities in response deficiencies.
3) Follow up on noncompliance items from previous audits.
4) Provide continued improvement in the system through feedback to management.
5) Cause the auditee to think about the process, thereby encouraging possible improvement.

AUDITOR:

A qualified individual who have received training in auditing principles and procedures should perform audits.

TECHNIQUES:

During the audit the auditor should employee three methods:

1) Examination of documents
2) Observation of activates
3) Interviews

Examination of Documents:

The auditor should examine the documents in a systematic manner

1) Documents are identified with a title, revision date, and responsible owner.
2) Documents are readily available to users
3) A master list by departments or function for procedures, work instructions, and records is appropriately located.
4) There are no obsolete documents at workstations.
5) Changes follow a prescribed procedure.

Observation Activity:

It requires an aptitude for details.

Interviews:

1) Place the auditee in a non threading environment
2) Encourage employees to talk about the process.
3) Focus on the system not on the auditee.
4) Discuss the major issues informally with the auditee first.
5) Use the appropriate type of questions.

PROCEDURE:

- Before the audit takes place an audit plan and check list should be prepared.
- The audit itself has three parts

1) The preaudit meeting
2) The audit
3) A closing meeting

Stages of an audit

- Four stages
    1. Audit planning
    2. Audit performance
    3. Audit reporting
    4. Audit follow up

Audit planning

- Key elements in the audit planning stages are
    - Audit schedules : it is a matrix of timing
    - Audit personnel : refers to the appointment of an auditor.
    - Notification to the auditee formal and timely request by audit to auditee for making available all quality system documents relevant to the audit.
    - Preparation of check list :all specific questions to be asked during audit.

Audit performance

- Key elements in the audit performance stages are
    - Opening entry meeting
    - Audit process
    - Audit deficiencies

Audit reporting

	• It deals with recording of any non conformity and summarizing the auditing. • Audit report may contain Identification of the reference documents against which audit is conducted. observation of non conformity corrective action request. Audit follow up • The auditor is responsible only for identifying the non conformity . But the auditee is responsible for determining and imitating corrective action needed to correct a non conformity. • Corrective action and subsequent follow up should be completed within a time period agreed to by the client and the auditee in consultation with the auditing organization.
5	**Explain the major elements of Environmental Management System. (April, 2014)** An EMS meeting the requirements of ISO 14001:2004 is a management tool enabling an organization of any size or type to: ▪ identify and control the environmental impact of its activities, products or services, and to ▪ improve its environmental performance continually, and to ▪ implement a systematic approach to setting environmental objectives and targets, to achieving these and to demonstrating that they have been achieved. General requirements • Environmental policy • Planning • Implementation and operation • Checking and corrective action • Management review
6	**Discuss about implementation of ISO 9001. (Nov/Dec2016)** **Implementation steps** • Top management commitment • Appoint the management representative • Awareness • Appoint an implementation team • Training • Time schedule • Select element owners • Review the present system • Write the document • Install the new system. • Internal audit • Management review • Pre-assessment • Registration
7	**Explain the benefits of EMS. (Nov/Dec 2011)** a. Global • Facilitate trade and remove trade barriers • improve environmental performance of planet earth • Build consensus that there is a need for environment management and a common terminology for EMS. b. Organizational • Assuring customers of a commitment to environmental management • Meeting customer requirements • Maintaining a good public / community relations image • Satisfying investor criteria and improving access to capital • Obtaining insurance at reasonable cost • Increasing market share that results from a competitive advantage

	• Reducing incidents that result in liability
8	**Explain ISO 14000 standards and list the benefits /What are the requirements , objectives and benefits of ISO 14000 system?(May /June 2016)** **ISO 14000** is a family of standards related to environmental management that exists to help organizations (a) minimize how their operations (processes, etc.) negatively affect the environment (i.e., cause adverse changes to air, water, or land); (b) comply with applicable laws, regulations, and other environmentally oriented requirements, and (c) continually improve in the above. ISO 14001 is known as a generic management system standard, meaning that it is relevant to any organization seeking to improve and manage resources more effectively. This includes: • single-site to large multi-national companies • high-risk companies to low-risk service organizations • manufacturing, process, and the service industries, including local governments • all industry sectors including public and private sectors • original equipment manufacturers and their suppliers. All standards are periodically reviewed by ISO to ensure they still meet market requirements. some of the benefits of implementing an Environmental Management System (EMS) in accordance with the ISO14000 standards, include: • identifying areas for reduction in energy and other resource consumption and their associated costs, • reducing environmental liability and risk, • helping to maintain consistent compliance with legal & regulatory requirements, • potentially faster permitting processes with state agencies, • benefiting form regulatory incentives that reward companies showing environmental leadership through certified compliance with environmental excellence, • preventing pollution and reducing waste, both of which reduces costs, • responding in a positive fashion to pressure from customers and shareholders, • improving community goodwill, • profiting in the market for "green" products, and generally achieving a market advantage, • lower insurance costs by demonstrating proof of good management before pollution-incident coverage is issued, and • demonstrating commitment to high-quality.
9	**Discuss the need for standardization procedures for quality assurance. (May /June 2016)** **Quality assurance** (**QA**) is a way of preventing mistakes or defects in manufactured products and avoiding problems when delivering solutions or services to customers; which ISO 9000 defines as "part of quality management focused on providing confidence that quality requirements will be fulfilled".[1] This defect prevention in quality assurance differs subtly from defect detection and rejection in quality control, and has been referred to as a shift left as it focuses on quality earlier in the process.[2] The terms "quality assurance" and "quality control" are often used interchangeably to refer to ways of ensuring the quality of a service or product.[3] For instance, the term "assurance" is often used as follows: Implementation of inspection and structured testing as a measure of quality assurance in a television set software project at Philips Semiconductors is described.[4] The term "control", however, is used to describe the fifth phase of the DMAIC model. DMAIC is a data-driven quality strategy used to improve processes.[5] Quality assurance comprises administrative and procedural activities implemented in a quality system so that requirements and goals for a product, service or activity will be fulfilled.[3] It is the

systematic measurement, comparison with a standard, monitoring of processes and an associated feedback loop that confers error prevention.[6] This can be contrasted with quality control, which is focused on process output.

Two principles included in quality assurance are: "Fit for purpose" (the product should be suitable for the intended purpose); and "right first time" (mistakes should be eliminated). QA includes management of the quality of raw materials, assemblies, products and components, services related to production, and management, production and inspection processes.[citation needed]

Suitable quality is determined by product users, clients or customers, not by society in general. It is not related to cost, and adjectives or descriptors such as "high" and "poor" are not applicable. For example, a low priced product may be viewed as having high quality because it is disposable, whereas another may be viewed as having poor quality because it is not disposable

10 **Explain the requirements of ISO system to documentation. (May /June 2016)**

ISO 9001 REQUIREMENTS

- The standard has 8 clauses

1) Scope
2) Normative Reference
3) Terms and Definitions
4) Quality Management Systems
5) Management Responsibility
6) Resource Management
7) Product Realization
8) Measurement Analysis and Improvement

1. Scope

To provide a product that meets

a) Customer Requirement
b) Regulatory Requirements
c) Customers Satisfaction

2. Normative Reference:

Fundamentals and vocabulary

3. Terms and Definitions:

Supplier→ Organization→ Customers

4. Quality Management System:

a) General Requirements
b) Documentation
* General Documentation
* Quality Manual
* Control of Documents
* Control of Records

5) Management Responsibility:

a) Management commitment
b) Customer Focus
c) Quality policy
d)Planning
* Quality Objectives
* Quality Management System Planning
e) Responsibility, Authority, And Communication
* Responsibility and Authority
* Management Representative
* Internal Communication

f) Management Review
* General Management
* Review Input
* Review Output

6) Resource Management :

a) Provision of Resources
b) Human Resources
* General
* Competence, Awareness and Training
c) Infrastructure
d) Work Environment

7. Product Realization
a) Planning of product Realization
b) Customer Related Processes
* Determination Of Requirement Related to the Product
* Review Of Requirement Related to the Product
*Customer Communication
c) Design And Development
* Design And Development Planning
* Design And Development Inputs
* Design And Development Outputs
* Design And Development Review
* Design And Development Verification
* Design And Development Validation
* Control of Design And Development Changes
d) Purchasing
* Purchasing Process
* Purchasing Information
* Verification Of Purchased Product

e)Production And service Provision
* Control Of Production And service Provision
* Validation Of Processes For Production And service Provision
*Identification And Traceability
* Customer Property
* Preservation of Product

f) Control Of Monitoring And Measuring Devices

8) Measurement , Analysis, And Improvement
a) General
b) Monitoring And Measurement
* Customer Satisfaction
* Internal Audit
* Monitoring And Measurement Of Processes
* Monitoring And Measurement of Product and Service
c) Control Of Nonconforming Product
d) Analysis Of Data
e) Improvement
* continual improvement
* corrective Action
* preventive Action

11	**Explain various divisions of ISO 14000 Standards. (Nov/Dec2016).** The new series of ISO14000 standards are designed to cover:

	• environmental management systems • environmental auditing • environmental performance evaluation • environmental labeling • life-cycle assessment • environmental aspects in product standards
12	**Enumerate the various aspects of ISO 14000 environmental management system. Brief the various principles of ISO 14000 series.** ***(April/May2017)*** ➢ identifying areas for reduction in energy and other resource consumption and their associated costs, reducing environmental liability and risk, helping to maintain consistent compliance with legal & regulatory requirements ➢ potentially faster permitting processes with state agencies. ➢ benefiting form regulatory incentives that reward companies showing environmental leadership through certified compliance with environmental excellence. ➢ preventing pollution and reducing waste, both of which reduces costs. ➢ responding in a positive fashion to pressure from customers and shareholders. ➢ improving community goodwill. ➢ profiting in the market for "green" products, and generally achieving a market advantage. ➢ lower insurance costs by demonstrating proof of good management before pollution-incident coverage is issued, and demonstrating commitment to high-quality. **principles of ISO 14000 series:** (a) minimize how their operations (processes, etc.) negatively affect the environment (i.e., cause adverse changes to air, water, or land); (b) comply with applicable laws, regulations, and other environmentally oriented requirements, and (c) continually improve in the above.
13	Illustrate the detailed procedure for quality auditing. Brief the attributes of a good auditor. ***(April/May2017)*** Definition : A systematic and independent examination to determine whether quality activities and related results comply with planned arrangement , whether these arrangements are implemented effectively and are suitable to achieve objectives. <u>PROCEDURE:</u> • Before the audit takes place an audit plan and check list should be prepared. • The audit itself has three parts 1) The preaudit meeting 2) The audit 3) A closing meeting Stages of an audit • Four stages 1. Audit planning 2. Audit performance 3. Audit reporting 4. Audit follow up Audit planning • Key elements in the audit planning stages are – Audit schedules : it is a matrix of timing – Audit personnel : refers to the appointment of an auditor. – Notification to the auditee formal and timely request by audit to auditee for making available all quality system documents relevant to the audit. – Preparation of check list :all specific questions to be asked during audit. Audit performance • Key elements in the audit performance stages are – Opening entry meeting – Audit process

– Audit deficiencies

Audit reporting

- It deals with recording of any non-conformity and summarizing the auditing.
- Audit report may contain

Identification of the reference documents against which audit is conducted.

observation of non-conformity

Corrective action request.

Audit follow up

- The auditor is responsible only for identifying the non-conformity . But the auditee is responsible for determining and imitating corrective action needed to correct a non-conformity.
- Corrective action and subsequent follow up should be completed within a time period agreed to by the client and the auditee in consultation with the auditing organization.