LECTURE NOTES
MG1301 – TOTAL QUALITY MANAGEMENT

UNIT I  INTRODUCTION  9
Definition of quality – Dimensions of quality – Quality planning – Quality costs – Analysis
techniques for quality costs – Basic concepts of total quality management – Historical
review – Principles of TQM – Leadership – Concepts – Role of senior management –
Quality council – Quality statements –Strategic planning – Deming philosophy – Barriers to
TQM implementation.

UNIT II  TQM PRINCIPLES  9
Customer satisfaction – Customer perception of quality – Customer complaints – Service
quality –Customer retention – Employee involvement – Motivation, empowerment, teams,
recognition and reward – Performance appraisal – Benefits – Continuous process
improvement – Juran trilogy – PDSA cycle – 5S – Kaizen – Supplier partnership –
Partnering – Sourcing – Supplier selection – Supplier rating – Relationship development –
Performance measures – Basic concepts – Strategy –Performance measure.

UNIT III  STATISTICAL PROCESS CONTROL (SPC)  9
The seven tools of quality – Statistical fundamentals – Measures of central tendency and
dispersion – Population and sample – Normal curve – Control charts for variables and
attributes – Process capability – Concept of six sigma – New seven management tools.

UNIT IV  TQM TOOLS  9
Benchmarking – Reasons to benchmark – Benchmarking process – Quality Function
Deployment(QFD) – House of quality – QFD process – Benefits – Taguchi quality loss
function – Total Productive Maintenance (TPM) – Concept – Improvement needs – FMEA
– Stages of FMEA.

UNIT V  QUALITY SYSTEMS  9
14000 –Concept – Requirements and benefits.

Total: 45

TEXT BOOKS

REFERENCES
South-Western (Thomson Learning), 2002.
1989.
Age International, 1996.
UNIT I - TOTAL QUALITY MANAGEMENT

Total Quality Management (TQM) is an enhancement to the traditional way of doing business.

Total - Made up of the whole
Quality - Degree of Excellence a Product or Service provides.
Management - Art of handling, controlling, directing etc.

TQM is the application of quantitative methods and human resources to improve all the processes within an organization and exceed CUSTOMER NEEDS now and in the future.

DEFINING QUALITY

Quality can be quantified as follows

\[ Q = \frac{P}{E} \]

Where

\[ Q \text{ = Quality} \]
\[ P \text{ = Performance} \]
\[ E \text{ = Expectation} \]
**DIMENSIONS OF QUALITY:**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Meaning and Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>Primary product characteristics, such as the brightness of the picture</td>
</tr>
<tr>
<td>Features</td>
<td>Secondary characteristics, added features, such as remote control</td>
</tr>
<tr>
<td>Conformance</td>
<td>Meeting specifications or industry standards, workmanship</td>
</tr>
<tr>
<td>Reliability</td>
<td>Consistency of performance over time, average time of the unit to fail</td>
</tr>
<tr>
<td>Durability</td>
<td>Useful life, includes repair</td>
</tr>
<tr>
<td>Service</td>
<td>Resolution of problems and complaints, ease of repair</td>
</tr>
<tr>
<td>Response</td>
<td>Human – to – human interface, such as the courtesy of the dealer</td>
</tr>
<tr>
<td>Aesthetics</td>
<td>Sensory characteristics, such as exterior finish</td>
</tr>
<tr>
<td>Reputation</td>
<td>Past performance and other intangibles, such as being ranked first</td>
</tr>
</tbody>
</table>

**QUALITY PLANNING**

The following are the important steps for quality planning.

1. Establishing quality goals.
2. Identifying customers.
3. Discovering customer needs.
4. Developing product features.
5. Developing process features.
6. Establishing process controls and transferring to operations.

**IMPORTANT POINTS TO BE NOTED WHILE QUALITY PLANNING:**

1. Business, having larger market share and better quality, earn returns much higher than their competitors.
2. Quality and Market share each has a strong separate relationship to profitably.
3. Planning for product quality must be based on meeting customer needs, not just meeting product specifications.

4. For same products. We need to plan for perfection. For other products, we need to plan for value.

**QUALITY COSTS**

**QUALITY COSTS:-**

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

**ELEMENTS OF QUALITY COST:-**

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

**ANALYSIS OF QUALITY COSTS:-**

- Trend analysis
- Pareto analysis

**1. PREVENTION COST**

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

**2. APPRAISAL COST**

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

3. INTERNAL FAILURE COST

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

4. EXTERNAL FAILURE COST

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

ANALYSIS TECHNIQUES OF QUALITY COST

The purpose of quality cost analysis is to determine the cost of maintaining a certain level of quality.

Such activity is necessary to provide feedback to management on the performance of quality assurance and to assist management in identifying opportunities.

INDEX NUMBERS:

Index Numbers are often used in a variety of applications to measure prices, costs (or) other numerical quantities and to aid managers in understanding how conditions in one period compare with those in other periods.
A simple type of index is called a RELATIVE INDEX.

<table>
<thead>
<tr>
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<th>COST IN RS.</th>
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<tbody>
<tr>
<td>1</td>
<td>2000</td>
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<tr>
<td>2</td>
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<tr>
<td>3</td>
<td>2100</td>
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<td>4</td>
<td>1900</td>
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</table>

Cost Index in quarter t = (Cost in quarter t / Base period cost) x 100

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<tr>
<th>QUARTER</th>
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<td>3</td>
<td>(2100/2000) x 100 = 105</td>
</tr>
<tr>
<td>4</td>
<td>(1900/2000) x 100 = 95</td>
</tr>
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</table>

**TREND ANALYSIS:**

- Good visual aids are important communication tools.
- Graphs are particularly useful in presenting comparative results to management.

Trend Analysis is one where Time-to-Time comparisons can be made which illustrates...
PARETO ANALYSIS:

- Joseph Juran observed that most of the quality problems are generally created by only a few causes.
- For example, 80% of all internal failures are due to one (or) two manufacturing problems.
- Identifying these “vital few” and ignoring the “trivial many” will make the corrective action give a high return for a low money input.

![Pareto Diagram]

BASIC CONCEPTS OF TOTAL QUALITY MANAGEMENT:

- Top management committed to quality in all aspects
- Customers focus of the organization
- Process focus and improvement
- Measurement of performance
- Employee involvement and empowerment
- Continuous improvement
- Benchmarking
- Teams
Supplier teaming
Training of employees
Inventory management
Communication
Quality cost.

PILLARS OF TQM:
Problem solving discipline
Interpersonal skills
Teamwork
Quality improvement process.

PRINCIPLES OF TQM:
Customer’s requirements must be met the first time, every time.

There must be agreed requirements, for both internal and external customers.
Everybody must be involved, from all levels and across all functions.
Regular communication with staff at levels is must. Two way communication at all levels must be promoted.
Identifying training needs and relating them with individual capabilities and requirements is must.
Top management’s participation and commitment is must.

A culture of continuous improvement must be established.
Emphasis should be placed on purchasing and supplier management
Every job must add value.
Quality improvement must eliminate wastes and reduce total cost.
There must be a focus on the prevention of problems.
A culture of promoting creativity must be established.
Performance measure is a must at organization, department and individual levels. It helps to assess and meet objectives of quality.
There should be focus on team work.

**SIX BASIC CONCEPTS OF TOTAL QUALITY MANAGEMENT**

1. Management Commitment
2. Customer Focus
3. Involvement and utilization of entire work force
4. Continuous Improvement
5. Treating Suppliers as Partners
6. Establish Performance Measures for the processes

**NEW AND OLD CULTURES :**

**QUALITY ELEMENTPREVIOUS STATE TQM**

<table>
<thead>
<tr>
<th>DEFINITION</th>
<th>PRODUCT ORIENTED</th>
<th>CUSTOMER</th>
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<tbody>
<tr>
<td>Priorities</td>
<td>Second to service</td>
<td>First among equals of and</td>
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<tr>
<td>DECISIONS</td>
<td>SHORT TERM</td>
<td>LONG TERM</td>
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<tr>
<td>Emphasis</td>
<td>Detection</td>
<td>Prevention</td>
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<td></td>
<td>Operations</td>
<td>System</td>
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<tr>
<td>Responsibility</td>
<td>Quality control</td>
<td>Everyone</td>
</tr>
<tr>
<td>Solving</td>
<td>Managers</td>
<td>Teams</td>
</tr>
<tr>
<td>Procurement</td>
<td>Price</td>
<td>Life cycle costs,</td>
</tr>
<tr>
<td>Partnership</td>
<td></td>
<td></td>
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</tbody>
</table>
### Manager’s Role
- Plan, assign, control
- Delegate, coach, and enforce
- Facilitate and mentor

### GURUS OF TQM:

<table>
<thead>
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<th>Contributions</th>
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<tr>
<td>SHEWHART</td>
<td>- Control chart theory</td>
</tr>
<tr>
<td></td>
<td>- PDCA Cycle</td>
</tr>
<tr>
<td>DEMING</td>
<td>- Statistical Process Control</td>
</tr>
<tr>
<td>JURAN</td>
<td>- Concepts of SHEWHART</td>
</tr>
<tr>
<td></td>
<td>- Return on Investment (ROI)</td>
</tr>
<tr>
<td>FEIGANBAUM</td>
<td>- Total Quality Control</td>
</tr>
<tr>
<td></td>
<td>- Management involvement</td>
</tr>
<tr>
<td></td>
<td>- Employee involvement</td>
</tr>
<tr>
<td></td>
<td>- Company wide quality control</td>
</tr>
<tr>
<td>ISHIKAWA</td>
<td>- Cause and Effect Diagram</td>
</tr>
<tr>
<td></td>
<td>- Quality Circle concept</td>
</tr>
<tr>
<td>CROSBY</td>
<td>- “Quality is Free”</td>
</tr>
<tr>
<td></td>
<td>- Conformance to requirements</td>
</tr>
<tr>
<td>TAGUCHI</td>
<td>- Loss Function concept</td>
</tr>
</tbody>
</table>
Design of Experiments

OBSTACLES IN IMPLEMENTING TQM:

- Lack of Management Commitment
- Inability to change Organizational culture
- Improper planning
- Lack of continuous training and education
- Incompatible organizational structure and isolated individuals and departments
- Ineffective measurement techniques and lack of access to data and results
- Paying inadequate attention to internal and external customers
- Inadequate use of empowerment and teamwork
- Failure to continually improve

BENEFITS OF TQM:

- Improved quality
- Employee participation
- Team work
- Working relationships
- Customer satisfaction
- Employee satisfaction
- Productivity
- Communication
- Profitability
- Market share

LEADERSHIP

LEADERSHIP:-

“Leadership is lifting of man”s visions to higher sights, the raising of man”s performance to
a higher standard, the building of man’s personality beyond its normal limitations”.

**CHARACTERISTICS FOR LEADERSHIP:-**

The customers first. Value people.

Built supplier partnership.
Empower people.
Demonstrate involvement/commitment. Strive for excellence.

**LEADERSHIP ROLES:-**

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

**Leaders**

- Shape the Organization’s value

- Promote the Organization’s value

- Protect the Organization’s value and

- Exemplifies the Organization values

**CHARACTERISTICS OF QUALITY LEADERS**:

1. They give priority attention to external and internal customers and their needs.
2. They empower, rather than control, subordinates.
3. They emphasize improvement rather than maintenance.
4. They emphasize prevention.
5. They emphasize collaboration rather than competition.
6. They train and coach, rather than direct and supervise.

7. They learn from the problems.
8. They continually try to improve communications.
9. They continually demonstrate their commitment to quality.
10. They choose suppliers on the basis of quality, not price.
11. They establish organizational systems to support the quality effort.
12. They encourage and recognize team effort.

LEADERSHIP CONCEPTS:

A leader should have the following concepts
1. People, paradoxically, need security and independence at the same time.
2. People are sensitive to external and punishments and yet are also strongly self-motivated.
3. People like to hear a kind word of praise. Catch people doing something right, so you can pat them on the back.
4. People can process only a few facts at a time; thus, a leader needs to keep things simple.
5. People trust their gut reaction more than statistical data.
6. People distrust a leader’s rhetoric if the words are inconsistent with the leader’s actions.

THE 7 HABITS OF HIGHLY EFFECTIVE PEOPLE:

1. Be Proactive
2. Begin with the End in mind
3. Put First Things First
4. Think Win – Win
5. Seek First to Understand, then to Be Understood
6. Synergy
7. Sharpen the Saw (Renewal)

**ROLE OF SENIOR MANAGEMENT**
1. Management by Wandering Around (MBWA).
2. Strategy of problem solving and decision making.
4. Recognition and Reward system.
5. Spending most of the time on Quality.
6. Communication.
7. Identify and encourage potential employee.
8. Accept the responsibility.
9. To play a role model.
10. Remove road blocks.
11. Study TQM and investigate how TQM is implemented elsewhere.
12. Establish policies related to TQM.
13. Establish „priority of quality“ and „customer satisfaction“ as the basic policy.
14. Assume leadership in bringing about a cultural change.
15. Check whether the quality improvement programmes are conducted as planned.
16. Become coaches and cheer leaders to implement TQM.
17. Generate enthusiasm for TQM activities.
18. Visit other companies to observe TQM functioning.
19. Attend TQM training programme.
20. Teach others for the betterment of society and the surroundings.

**QUALITY COUNCIL**

A quality council is established to provide overall direction. The council is composed of

- Chief Executive Officer
- Senior Managers
- Coordinator or Consultant
- A representative from the Union

Duties of the council are

- Develop the core values, vision statement, mission statement and quality policy statement
- Develop the strategic long term plan with goals and Annual Quality improvement Program with objectives
- Create the total education and training plan
- Determine and monitor the cost of poor quality
- Determine the performance measures
- Determine projects those improve the process
- Establish multifunctional project and work group teams
- Revise the recognition and rewards system

A typical meeting agenda will have the following items

- Progress report on teams
- Customer satisfaction report
- Progress on meeting goals
- New project teams
- Benchmarking report

Within three to five years, the quality council activities will become ingrained in the culture of the organization.
VISION STATEMENT:

- It is a short declaration of what an organization aspires to be tomorrow. Example:
  Disney Theme Park - Happiest place on earth
  Polaroid - Instant photography

- Successful visions provide a guideline for decision making

MISSION STATEMENT:

It answers the following questions

- Who are the customers?
- What we do?
- How we do it?

It describes the function of the organization. It provides a clear statement of purpose for employees, customers & suppliers

A simpler mission statement is
- To meet customers transportation and distribution needs by being the best at moving their goods on time, safely and damage free

- NATIONAL RAILWAYS

QUALITY POLICY STATEMENT:
It is guide for everyone in the organization as to how they should provide products and services to the customers.

Common characteristics are

☐ Quality is first among equals
☐ Meet the needs of the internal & external customers
☐ Equal or exceed competition
☐ Continuously improve the quality
☐ Utilize the entire workforce

**STRATEGIC QUALITY PLANNING**

Goals – Long term planning (Eg: in the war)

Objectives – Short term planning (Eg: Capture the bridge)

Goals should

☐ Improve customer satisfaction, employee satisfaction and process
☐ Be based on statistical evidence
☐ Be measurable
☐ Have a plan or method for its achievement
☐ Have a time frame for achieving the goal
☐ Finally, it should be challenging yet achievable

**SEVEN STEPS TO STRATEGIC QUALITY PLANNING :**

1. Customer needs

2. Customer positioning

3. Predict the future

4. Gap analysis

5. Closing the gap

6. Alignment

7. Implementation
TQM IMPLEMENTATION:

- Begins with Management Commitment
- Leadership is essential during every phase of the implementation process and particularly at the start
- Senior Management should develop an implementation plan
- Timing of the implementation process is very important

DEMING PHILOSOPHY

Managers and First Line Supervisors is essential
n is a must
e organization
nd problem solving
ier surveys must be conducted to benchmark
ject teams and work groups and monitors their progress

1. Create and publish the Aims and Purposes of the organization.
2. Learn the New Philosophy.
3. Understand the purpose of Inspection.
4. Stop awarding business based on price alone.
5. Improve constantly and forever the System.
6. Institute Training.
7. Teach and Institute Leadership.
8. Drive out Fear, Create Trust and Create a climate for innovation.
9. Optimize the efforts of Teams, Groups and Staff areas.
11a. Eliminate numerical quotas for the work force.
12. Remove Barriers THAT ROB PEOPLE OF PRIDE OF WORKMANSHIP.

13. Encourage Education and Self-improvement for everyone. Take action to accomplish the transformation.

QUESTION BANK

UNIT- I INTRODUCTION-TQM

PART – A (2 MARKS)

1. Define Total Quality?
2. Define Quality?
3. What are the Dimensions of Quality?
4. Give the Basic Concepts of TQM?
5. Give the Principles of TQM?
6. Give the Obstacles associated with TQM Implementation?
7. Give the Analysis Techniques for Quality Costs?
8. Define Quality Costs?
9. Give the primary categories of Quality cost?
10. Give the typical cost bases?
11. How will you determine the optimum cost?
12. State the Quality Improvement Strategy?
13. Define Quality Planning?
14. Give the Objectives of TQM?
15. What is needed for a leader to be effective?
16. What is the important role of senior management?
17. What are the general duties of a quality council?

18. What does a typical meeting agenda contain after establishing the TQM?

19. What are the various quality statements?

20. Give the basic steps to strategic quality planning?

21. What is a quality policy?

**DEMING PHILOSOPHY**

- techniques used for Quality cost? (16)
- 16)
- )
- ementation? (16)
- ip? (16)
UNIT II – TQM PRINCIPLES AND CUSTOMER SATISFACTION

Customer satisfaction, a business term, is a measure of how products and services supplied by a company meet or surpass customer expectation. It is seen as a key performance indicator within business and is part of the four of a Balanced Scorecard.

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

Customer complaints:-
☐ Satisfied
☐ Dissatisfied customer
☐ Totally satisfied customer contributes to monitored.

FEEDBACK (INFORMATION COLLECTING TOOLS):

Feedback enables organization to

☐ Discover customer satisfaction
☐ Discover relative priorities of quality
☐ Compare performance with the competition
☐ Identify customer needs
☐ Determine opportunities for improvement

Listening to the voice of the customer can be accomplished by numerous information collecting tools.

1. Comment Card
2. Customer Questionnaire

<table>
<thead>
<tr>
<th>Highly Satisfied</th>
<th>Neutral</th>
<th>Highly Dissatisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Trash removal</td>
<td>5 4 3 2 1</td>
<td></td>
</tr>
<tr>
<td>2. Personal hygiene</td>
<td>5 4 3 2 1</td>
<td></td>
</tr>
<tr>
<td>3. Romance</td>
<td>5 4 3 2 1</td>
<td></td>
</tr>
</tbody>
</table>
4. Thoughtfulness 5 4 3 2 1
5. Listening skills 5 4 3 2 1
6. Faithfulness 5 4 3 2 1
7. Respect for 
Mother – in - law 5 4 3 2 1
8. Overall, how satisfied are you with your 
Marriage? 5 4 3 2 1

To make surveys more useful, it is best to remember eight points

- Clients and Customers are not the same
- Surveys raise customers expectations
- How you ask a question will determine how the question is answered
- The more specific the question, the better the answer
- You have only one chance and only 15 minutes
- The more time you spend in survey development, the less time you will spend in data analysis and interpretation
- Who you ask is as important as what you ask
- Before the data are collected, you should know how you want to analyse and use the data

3. Focus Groups
These groups are very effective for gathering information on customer expectations and requirements.

4. Toll – Free Telephone Numbers
5. Customer Visits
6. Report Card
7. The Internet and Computers
8. Employee Feedback
9. Mass Customization

**USING CUSTOMER COMPLAINTS:**
Actions an organization can take to handle complaints are as follows

- Investigate customers experiences by actively getting feedback, both positive and negative, and then acting on it promptly.
- Develop procedures for complaint resolution that include empowering front-line personnel.
- Analyze complaints, but understand that complaints do not always fit into neat categories.
- Work to identify process and material variations and then eliminate the root cause. “More inspection” is not corrective action.
- When a survey response is received, a senior manager should contact the customer and strive to resolve the concern.
- Establish customer satisfaction measures and constantly monitor them.
- Communicate complaint information, as well as the results of all investigations and solutions, to all people in the organization.
- Provide a monthly complaint report to the quality council for their evaluation and, if needed, the assignment of process improvement teams.
- Identify customers’ expectations beforehand rather than afterward through complaint analysis.

**SERVICE QUALITY**
Customer service is the set of activities an organization uses to win and retain customer’s satisfaction. It can be provided before, during, or after the sale of the product or exist on its own.

Elements of customer service are

**ORGANIZATION**

1. Identify each market segment.
2. Write down the requirements.
3. Communicate the requirements.
4. Organize processes.
5. Organize physical spaces.

CUSTOMER CARE
6. Meet the customer’s expectations.
7. Get the customer’s point of view.
8. Deliver what is promised.
9. Make the customer feel valued.
10. Respond to all complaints.
11. Over – respond to the customer.
12. Provide a clean and comfortable customer reception area.

COMMUNICATION
13. Optimize the trade – off between time and personal attention.
14. Minimize the number of contact points.
15. Provide pleasant, knowledgeable and enthusiastic employees.

FRONT-LINE PEOPLE
17. Hire people who like people.
18. Challenge them to develop better methods.
19. Give them the authority to solve problems.
20. Serve them as internal customers.
21. Be sure they are adequately trained.
22. Recognize and reward performance.
23. Lead by example.
24. Listen to the front-line people.
25. Strive for continuous process improvement.
LEADERSHIP

CHARACTERISTICS AND EXPECTATIONS:
Characteristic Expectation

Delivery Delivered on schedule in undamaged condition
Installation Proper instructions on setup, or technicians supplied for complicated products
Use Clearly-written training manuals or instructions provided on proper use
Field repair Properly-trained technicians to promptly make quality repairs
Customer Service Friendly service representatives to answer questions
Warranty Clearly stated with prompt service on claims

CUSTOMER RETENTION

It means “retaining the customer” to support the business. It is more powerful and effective than customer satisfaction.

For Customer Retention, we need to have both “Customer satisfaction & Customer loyalty”.

The following steps are important for customer retention.
1. Top management commitment to the customer satisfaction.
2. Identify and understand the customers what they like and dislike about the organization.
4. Recruit, train and reward good staff.
5. Always stay in touch with customer.
6. Work towards continuous improvement of customer service and customer retention.
7. Reward service accomplishments by the front-line staff.
8. Customer Retention moves customer satisfaction to the next level by determining what is truly important to the customers.
9. Customer satisfaction is the connection between customer satisfaction and bottom line.
EMPLOYEE INVOLVEMENT
Employee involvement is one approach to improve quality and productivity.

It is a means to better meet the organization’s goals for quality and productivity.

MOTIVATION: MASLOW’S HIERARCHY OF NEEDS:

Self - Actualization
   ↑
   Esteem
   ↑
   Social
   ↑
   Security
   ↑
   Survival

EMPLOYEE WANTS:

<table>
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<tr>
<th>FACTOR</th>
<th>EMPLOYEE RATING</th>
<th>MANAGER RATING</th>
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<tr>
<td>Interesting work</td>
<td>1</td>
<td>5</td>
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<tr>
<td>Appreciation</td>
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<tr>
<td>Involvement</td>
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<td>10</td>
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<tr>
<td>Job security</td>
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<td>Good Pay</td>
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</tr>
<tr>
<td>Promotion/ growth</td>
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<td>3</td>
</tr>
<tr>
<td>Good working conditions</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Loyalty to employees</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Help with personal problems</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Tactful discipline</td>
<td>10</td>
<td>6</td>
</tr>
</tbody>
</table>
ACHIEVING A MOTIVATED WORK FORCE:

The building of a motivated work force is for the most part an indirect process. Concepts to achieve a motivated work force are as follows:

1. Know thyself.
2. Know your employees.
3. Establish a positive attitude.
4. Share the goals.
5. Monitor progress.
6. Develop interesting work.
   - Job rotation
   - Job enlargement
   - Job enrichment
7. Communicate effectively

EMPLOYEE SURVEYS:

Employee surveys help managers assess the current state of employee relations, identify trends, measure the effectiveness of program implementation, identify needed improvements, and increase communication effectiveness.

STEP 1: The Quality Council to create a multifunctional team
STEP 2: The Team will develop survey instrument
STEP 3: Administer the survey
STEP 4: Results are compiled and analyzed
STEP 5: Determine areas for improvement

- Employee involvement is creating an environment in which people have an impact on decisions and actions that affect their jobs. Tell: the supervisor makes the decision and announces it to staff. The supervisor provides complete direction.
- Sell: the supervisor makes the decision and then attempts to gain commitment from staff by "selling" the positive aspects of the decision.
- Consult: the supervisor invites input into a decision while retaining authority to make the final decision herself.
- Join: the supervisor invites employees to make the decision with the supervisor. The supervisor considers her voice equal in the decision process.

To round out the model, I add the following.

- Delegate: the supervisor turns the decision over to another party.

SEVEN RULES OF MOTIVATION

#1 Set a major goal, but follow a path. The path has mini goals that go in many directions. When you learn to succeed at mini goals, you will be motivated to challenge grand goals.
#2 Finish what you start. A half finished project is of no use to anyone. Quitting is a habit. Develop the habit of finishing self-motivated projects.
#3 Socialize with others of similar interest. Mutual support is motivating. We will develop the attitudes of our five best friends. If they are losers, we will be a loser. If they are winners, we will be a winner. To be a cowboy we must associate with cowboys.
#4 Learn how to learn. Dependency on others for knowledge supports the habit of procrastination. Man has the ability to learn without instructors. In fact, when we learn the art of self-education we will find, if not create, opportunity to find success beyond our
wildest dreams.

#5 Harmonize natural talent with interest that motivates. Natural talent creates motivation, motivation creates persistence and persistence gets the job done.

#6 Increase knowledge of subjects that inspires. The more we know about a subject, the more we want to learn about it. A self-propelled upward spiral develops.

#7 Take risk. Failure and bouncing back are elements of motivation. Failure is a learning tool. No one has ever succeeded at anything worthwhile without a string of failures.

**EMPOWERMENT**

Empowerment is investing people with authority. It's purpose is to tap the enormous reservoir of potential contribution that lies within every worker. The two steps to empowerment are

1. To arm people to be successful through coaching, guidance and training.
2. Letting people do by themselves.

The principles of empowering people are given below.

1. Tell people what their responsibilities are.
2. Give authority.
4. Render training.
5. Provide knowledge and information.
6. Trust them.
7. Allow them to commit mistakes.
8. Treat them with dignity and respect. Three dimensions of empowerment are
   - Capability
   - Alignment and
   - Trust

Employee involvement is optimized by the use of teams.

- 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 during which each member of the team subordinates his individual interests and opinions to fulfill the objectives or goals of the group.

WHY TEAMS WORK:
1. Many heads are more knowledgeable than one.
2. The whole is greater than the sum of its members.
3. Team members develop a rapport which each other.
4. Teams provide the vehicle for improved communication.

TYPES OF TEAMS:
1. Process improvement team.
3. Natural work teams.
4. Self – Directed / Self – Managed work teams.

CHARACTERISTICS OF SUCCESSFUL TEAMS:
1. Sponsor
2. Team Charter
3. Team Composition
4. Training
5. TEAM MEMBER ROLES:
6. Clear Objectives
7. Well-Defined decision procedure
8. Trust
9. Open Communication
10. Balanced Participation
TEAM LEADER

- Ensures the smooth and effective operation of the team.
- Facilitates the team process.
- Serves as a Contact Point.
- Organizes the implementation of changes.
- Prepares the meeting agenda.

FACILITATOR

- Supports the leader.
- Focuses on the team process.
- Acts as a resource to the team.
- Provides feedback to the team.

RECORDER

- Documents the main ideas of the team's discussion, the issues raised, decisions made, action items etc.
- Presents the documents and distributes the MOM.
- Participates as a team member.

TIMEKEEPER

- Ensures that the team maintains the schedule.
- Participates as a team member.
TEAM MEMBER

☐ Contributes best, without reservation.
☐ Respects other people's contributions.
☐ Listens carefully and asks questions.
☐ Works for consensus on decisions.
☐ Supports the decision of the team.
☐ Understands and is committed to the team objectives.

Respects and is tolerant of individual differences.
☐ Acknowledges and works through conflict openly.
☐ Carries out assignments.

DECISION MAKING METHODS:

1. Non-decision.
2. Unilateral decision.
3. Handclasp decision.
4. Minority-rule decision.
5. Majority-rule decision.

COMMON BARRIERS TO TEAM PROGRESS:

☐ Insufficient training.
☐ Incompatible rewards and compensation.
☐ First-line supervisor resistance.
☐ Lack of planning.
☐ Lack of management support.
☐ Access to information systems.
☐ Lack of Union support.
Project scope too large.

Project objectives are not significant.

No clear measures of success.

No time to do improvement work.

RECOGNITION AND REWARD

Recognition is a process by which management shows acknowledgement of an employee’s outstanding performance.

Various ways for Recognition and Rewards are

1. Recognition can be expressed using verbal and written praise.

2. Rewards may be in the form of certificates and plaques.

3. Reward is normally in the form of cinema tickets, dinner for family etc.

4. The financial compensation (for recognition) can be paid in terms of increased salaries, commissions, gain sharing etc.

5. The efforts of employees can be recognized by promotions, special job assignments etc.

6. A letter of appreciation from the CEO or the Top Management will increase the employee’s involvement.

7. Reward may be delayed but recognition should be in a timely basis.

8. Rewards should be appropriate to the improvement level.

9. People like to be recognized than any reward.

10. Special forms of recognition include pictures on the bulletin board, articles in news letters, letter to families etc.

11. Supervisors can give on-the-spot praise for a job which is done well.

EFFECTS OF RECOGNITION AND REWARD SYSTEM:

1. Recognition and reward go together for letting people know that they are valuable members for the organization.

2. Employee involvement can be achieved by recognition and reward system.

3. Recognition and reward system reveals that the organization considers quality and productivity as important.
4. It provides the organization an opportunity to thank high achievers.
5. It provides employees a specific goal to achieve.
6. It motivates employees to improve the process.
7. It increases the morale of the workers.

PERFORMANCE APPRAISAL

The performance appraisal is used to let employees know how they are performing. The performance appraisal becomes a basis for promotions, increase in salaries, counseling and other purposes related to an employee's future.

IMPORTANCE OF PERFORMANCE APPRAISALS:

1. It is necessary to prevail a good relationship between the employee and the appraiser.
2. Employee should be informed about how they are performing on a continuous basis, not just at appraisal time.
3. The appraisal should highlight strength and weakness and how to improve the performance.
4. Employee should be allowed to comment on the evaluation and protest if necessary.
5. Everyone should understand that the purpose of performance appraisal is to have employee involvement.
6. Errors in performance evaluations should be avoided.
7. Unfair and biased evaluation will render poor rating and hence should be eliminated.

BENEFITS OF EMPLOYEE INVOLVEMENT:

Employee involvement improves quality and increases productivity because

- Employees make better decisions using their expert knowledge of the process
- Employees are better able to spot and pin-point areas for improvement.
- Employees are better able to take immediate corrective action.
- Employee involvement reduces labour / management friction.
Employee involvement increases morale.

Employees have an increased commitment to goals because they are involved.

CONTINUOUS PROCESS IMPROVEMENT

Continuous process improvement is designed to utilize the resources of the organization to achieve a quality-driven culture.
Improvement is made by

- Viewing all work as process.
- Making all process effective, efficient and adaptable.
- Anticipating changing customer needs.
- Controlling in-process performance using measures such as scrap reduction, control charts etc.
- Eliminating waste and re-work.
- Eliminating non-value added activities.
- Eliminating non-conformities.
- Using Benchmarking.
- Incorporating learned lessons into future activities.
- Using technical tools such as SPC, benchmarking, experimental design, QFD etc.

Source: [24]
PROCESS:
Process refers to business and production activities of an organization.

INPUT / OUTPUT PROCESS MODEL

There are five basic ways for improvement.

- Reduce resources.
THE JURAN TRILOGY

1. PLANNING

- Determine internal & external customers.
- Their needs are discovered.
- Develop product / service features.
- Develop the processes able to produce the product / service features.
- Transfer plans to operations.

2. CONTROL

Control is used by operating forces to help meet the product, process and service requirements.

It consists of the following steps
1. Determine items to be controlled.
2. Set goals for the controls.
4. Compare actual performance to goals.
5. Act on the difference.

3. IMPROVEMENT

Aims to attain levels of performance that are higher than current levels.

It consists of the following steps
- Establishment of quality council.
- Identify the improvement projects.
- Establish the project teams with a project leader.
Provide the team with the resources.

THE PDCA CYCLE:

1. IDENTIFY THE OPPORTUNITY

- Identify the Problem
- Pareto analysis of external alarm signals.
- Pareto analysis of internal alarm signals.
- Proposals from key insiders.
- Proposals from suggestion schemes.
- Field study of user’s needs.
- Comments of key people outside the organization.
- Customer surveys.
- Employee surveys.
- Brainstorming by work groups.
Criteria for a good problem statement is as follows

- It clearly describes the problem.
- It states the effect.
- It focuses on what is known, unknown etc.
- It emphasizes the impact on the customer.

2. ANALYZE THE CURRENT PROCESS

The objective is to understand the process and how it is currently performed.
Step 1 : The team to develop a process flow diagram.
Step 2 : The target performance measures are defined.
Step 3 : Collection of all available data and information.

Common items of data and information are

1. Customer information 2. Design information
5. Quality information 6. Supplier information

3. DEVELOP THE OPTIMAL SOLUTION(S)

This phase has the objective of establishing potential and feasible solutions and recommending the best solution to improve the process.

- Creativity plays the major role, and brainstorming is the principal technique.

- There are three types of creativity:
  - Create new processes
  - Combine different processes
Modify the existing process

4. IMPLEMENT CHANGES

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

- Approval of the quality council.
- Obtain the advice and consent of departments, functional areas, teams, individuals etc.
- Monitor the activity.

5. STUDY THE RESULTS

This phase has the objective of monitoring and evaluating the change by tracking and studying the effectiveness of the improvement efforts.

6. STANDARDIZE THE SOLUTION

- Institutionalize by positive control of the process.
- The quality peripherals – the system, environment and supervision must be certified.
- Operators must be certified.

7. PLAN FOR THE FUTURE

The objective is to achieve improved level of process performance.

- Regularly conduct reviews of progress by the quality council.
- Establish the systems to identify area for future improvements.
- Track performance with respective internal & external customers.
- TQM tools and techniques are used to improve quality, delivery and cost.
5-S : HOUSEKEEPING

5-S MEANS EVERYTHING IN ITS PLACE

[Diagram of the 5S methodology with steps: Clearing, Arranging, Sweeping, Cleanliness, Discipline]
There can be no TQM without 5-S.

- A dirty factory cannot produce quality products.
- Clutter hides problems. A neat workplace promotes easy discovery of abnormalities.

The First S : SEIRI : CLEARING

**Flow Chart :**

**SEPARATING THE WANTED AND UNWANTED**

- Junk & waste
- Repairable
- Wanted items
  - No use
  - Repair
  - Discard
  - To next step

**Consequences of not practicing SEIRI :**
- The unwanted clutters up the place and the wanted are hard to find.
THE SECOND S : SEITON : ARRANGING

ARRANGE EVERYTHING IN PROPER ORDER SO THAT IT CAN BE EASILY PICKED UP FOR USE.

<table>
<thead>
<tr>
<th>Factory Floor</th>
<th>Office</th>
<th>Home</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ Unlabelled tool crib</td>
<td>♦ Unlabelled file cabinet</td>
<td>♦ Clutter</td>
</tr>
<tr>
<td>♦ Cluttered shelves</td>
<td>♦ Cluttered drawer, shelves, book cases,</td>
<td>♦ No orderly arrangement in</td>
</tr>
<tr>
<td>lockers etc.</td>
<td>tables</td>
<td>the rooms</td>
</tr>
<tr>
<td>♦ Stores – no clear location system.</td>
<td>♦ Records &amp; documents</td>
<td>♦ Not arranged well</td>
</tr>
<tr>
<td>♦ Things on the floor</td>
<td>♦ File heaps and papers</td>
<td></td>
</tr>
</tbody>
</table>

Consequences of not practicing SEITON :

♦ Things are seldom available when needed.

♦ Items are “lost” in stores.

♦ Items – defectives and good ones get mixed up.

♦ Accidents or near-accidents occur due to clutter.

♦ Visual control of the shop floor is not possible.

Sometimes, production is lost because an item required is available but cannot be found.

♦ In some offices, Critical Excise records or tax records may not be traceable. This can lead to finance loss, prosecution or embarrassment

THE THIRD S : SEISO : SWEEP
SWEEP YOUR WORKPLACE THOROUGHLY SO THAT THERE IS NO DUST ANYWHERE

<table>
<thead>
<tr>
<th>Factory Floor</th>
<th>Office</th>
<th>Home</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ Dirty machines</td>
<td>♦ Dirty table &amp; furniture</td>
<td>♦ Dirty furniture, floor,</td>
</tr>
<tr>
<td></td>
<td>♦ Dust on product parts, R.Mtls.</td>
<td>window, grills,</td>
</tr>
<tr>
<td></td>
<td>♦ Dirty jigs, fixtures</td>
<td>bookshelves.</td>
</tr>
<tr>
<td></td>
<td>♦ Dirty walls, roofs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ Littered floor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ Dirty windows</td>
<td></td>
</tr>
</tbody>
</table>

Consequences of not practicing SEISO:

- Most machines are affected by dust & dirt and hence their performance may go down.
- Dust and dirt on products, materials, packing boxes etc. will affect either their performance quality or their aesthetic look.
- Unpleasant to work in

THE FOURTH S : SEIKETSU : CLEANLINES

WASHING WITH A STRONG OVERTONE OF KEEPING THINGS DISINFECTED AS WELL AS FREE OF HAZARDOUS CHEMICALS.

<table>
<thead>
<tr>
<th>Factory Floor</th>
<th>Office</th>
<th>Home</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ Handling hazardous chemicals</td>
<td>♦ Free of pests</td>
<td>♦ Pest control</td>
</tr>
<tr>
<td>♦ Control of fumes, hazardous dust.</td>
<td>♦ Personal hygiene</td>
<td>♦ Personal hygiene</td>
</tr>
<tr>
<td>♦ Disinfecting, Personal hygiene</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Consequences of not practicing SEIKETSU:

- Good health and safety require the practice of Seiketsu.
- Hazardous chemicals, dusty chemicals, fumes etc. can make it a dangerous place to work in.
- Washing thoroughly and cleaning a place makes the workplace pleasant.
- Personal hygiene is essential for healthy workforce.

THE FIFTH S: SHITSUKI: DISCIPLINE

DISCIPLINE ESPECIALLY WITH REGARD TO SAFETY RULES AND

Consequences of not practicing SEIKETSU:

- If discipline is not practiced, then the first 4-S would backslide.
- Lack of Shitsuki means not following the standards. Then, all activities related to safety and quality will be affected.

IMPLEMENTING 5-S

Top Management resolve and training.

2. Formation of a top level team.

3. Understanding current circumstances.

4. Establishing priorities and targets.

5. Forming sub-teams and training.

6. Major cleaning.

7. Establishing improvement plans in each priority area.

8. Implementing the plan.

9. Verifying results.

10. Standardizing.

11. Establishing full control.

12. Looking for further improvements.
KAIZEN

Kaizen is a Japanese word for the philosophy that defines management’s roles in continuously encouraging and implementing small improvements involving everyone. It focuses on simplification by breaking down complex progress into their sub-processes and then improving them.

The Kaizen improvement focuses on the use of:

- Value-added and non-value work activities.
- Muda, which refers to the seven classes of waste – over-production, delay, transportation, processing, inventory, wasted motion, and defective parts.
- Principles of motion study and the use of cell technology.
- Principles of materials handling and use of one-piece flow.
- Documentation of standard operating procedures
- The five S’s for workplace organization.
- Visual management.
- Just-in-time principles.
- Poka-Yoke.
- Team dynamics
**RE-ENGINEERING**
It is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical measures of performance.

**SUPPLIER PARTNERSHIP**
The suppliers should be treated as partners to achieve the same quality level as attained within the organization.

The following forces need Supplier Partnership to improve quality, reduce costs and increase market share.

- Deming Philosophy (Deming’s 4th point)
- Just-in-time
- Continuous process improvement
- ISO 9000

**CUSTOMER – SUPPLIER RELATIONS :**
Dr. Kaoru Ishikawa has given ten principles of customer-supplier relations. They are

1. Both the customer and supplier are fully responsible for the control of quality.

2. Both the customer and supplier should be independent of each other.

3. The customer is responsible for providing the supplier with clear and sufficient requirements so that the customer can know precisely what to produce.

4. Both the customer and supplier should enter into a non-adversarial contract.

5. The supplier is responsible for providing the quality that will satisfy the customer.

6. Both the customer and supplier should decide the method to evaluate the quality of the product or services.

7. Both the customer and supplier should establish in the contract the method by which they can reach an amicable settlement in case of any dispute.

8. Both the customers and supplier should continually exchange information.

9. Both the customer and supplier should perform business activities.

10. Both the customer and supplier should have the best interest of the end user in mind.

**PARTNERING**
Partnering is a relationship between two or more parties based upon trust, dedication to common goals.
The benefits of partnering are

- Improved quality
- Increased efficiency
- Lower cost
- Increased opportunity for innovation
- Continuous improvement

The three key elements to a partnership relationship are

- Long term commitment
- Trust
- Shared Vision

**SOURCING**

The three types of sourcing are

- Sole sourcing
- Multiple sourcing
- Single sourcing

**SUPPLIER SELECTION**

The suppliers should be selected with the following ten conditions

1. The supplier should understand clearly the management philosophy of the organization.
2. The supplier should have stable management system.
3. The supplier should maintain high technical standards.
4. The supplier should provide the raw materials and parts which meet quality specifications required by the purchaser.
5. The supplier should have the required capability in terms of production.
6. The supplier should not leak out the corporate secrets.
7. The supplier should quote right price and should meet the delivery schedule. The supplier should be accessible with respect to transportation and communication.
8. The supplier should be sincere in implementing the contract provisions.
9. The supplier should have an effective quality system such as ISO / QS 9000.

10. The supplier should be renowned for customer satisfaction.

**SUPPLIER CERTIFICATION :**

A certified supplier is one which, after extensive investigation, is found to supply material of such quality that is not necessary to perform routine testing.

The Eight criteria for supplier certification are

1. No product related lot rejections for atleast 1 year.
2. No non-product related rejections for atleast 6 months.
3. No production related negative incidents for atleast 6 months.
4. Should have passed a recent on-site quality system evaluation.
5. Having a fully agreed specifications.
6. Fully documented process and quality system.
7. Timely copies of inspection and test data.
8. Process that is stable and in control.

**SUPPLIER RATING :**

Supplier Rating is done

- To obtain an overall rating of supplier performance.
- To communicate with suppliers regarding their performance.
- To provide each supplier with a detailed and true record of problems for corrective action.
- To enhance the relationship between the buyer and the supplier.

**RELATIONSHIP DEVELOPMENT :**

For establishment of supplier relationship, the following are necessary.

(a) Partnering

(b) Supplier selection

(c) Principles of customer / supplier relations
(d) Certification
(e) Periodic rating

For relationship development, the following are necessary.
(a) Inspection
   - 100% inspection
   - Sampling
   - Audit
   - Identity check

(b) Training
(c) Teams
(d) Recognition and Reward

PERFORMANCE MEASURES

Performance measures are required for the managers for managing an organization perfectly.
Performance measures are used to achieve the following objectives.
- To establish performance measures and reveal trend.
- To identify the processes to be improved.
- To determine the process gains and losses.
- To compare the actual performance with standard performance.
- To provide information for individual and team evaluation.
- To determine overall performance of the organization.
- To provide information for making proper decisions.

WHAT SHOULD BE MEASURED?

HUMAN RESOURCES

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

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

PRODUCTION
2. Inventory.
3. SPC Charts.
4. Amount of scrap / rework.

RESEARCH AND DEVELOPMENT
2. New product time to market.
3. Design change orders.

SUPPLIERS
2. On-time delivery.
5. Average lead time.

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

**ADMINISTRATION**

1. Revenue per employee.
2. Purchase order error.

**STRATEGY:**

The quality council has the overall responsibility for the performance measures. It ensures that all the measures are integrated into a total system of measures. A typical system contains the following function
- Quality
- Cost
- Flexibility
- Reliability
- Innovation

**PERFORMANCE MEASURE PRESENTATION:**

There are six basic techniques for presenting performance measures. They are
1. Time series graph.
2. Control charts.
3. Capability Index.
4. Taguchi’s loss function.
5. Cost of poor quality.

In MBNQA, five categories are analyzed. They are
a) Manufacturing
b) Service
c) Small business

d) Health care

e) Education

UNIT- II

TQM PRINCIPLES

PART – A (2 MARKS)

1. What is a mission statement?

2. What is a vision statement?

3. What are the important factors that influenced purchases?

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

5. List the tools used for feedback?

6. What are the activities to be done using customer complaints?

7. What are the elements of customer service?

8. Define Customer Retention?

9. Define Employee Involvement?

10. State Maslow's Hierarchy of Needs?

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

12. What does an employee want?

13. What are the concepts to achieve a motivated work force?

14. Define Empowerment?

15. What are the three conditions necessary to create the empowered environment?

16. What are the types of teams?

17. What are the characteristics of successful teams?

18. What are the decision-making methods?

19. What are the stages of team development?

20. Give some common team problems?

21. What are the common barriers to team progress?

22. Give the steps involved in training process?
23. Define Recognition and Reward?
24. What are the types of appraisal formats?
25. What are the benefits of employee involvement?
26. What are the basic ways for a continuous process improvement?
27. What are the three components of the Juran Trilogy?
28. What are the steps in the PDSA cycle?
29. What are the phases of a Continuous Process Improvement Cycle?
30. Define 5S?
31. What is a Kaizen?
32. What are the three key elements to a partnering relationship?
33. What are the three types of sourcing?
34. What are the ten conditions for the selection and evaluation of suppliers?
35. What are the characteristics used to measure the performance of a particular process?
36. Give the six basic techniques for presenting performance measures.
37. Give the usage of an effective recognition and reward system?
38. How will you improve the performance appraisal system?
39. What are the typical measurements frequently asked by managers and teams?

PART – B
1. Explain Juran trilogy for Continuous Process Improvement? (16)
2. Explain the PDSA cycle? (16)
3. Explain Kaizen principle? (16)
4. Explain how the employee will be involved in doing a process? (16)
UNIT III – STATISTICAL PROCESS CONTROL

TQM TOOLS (SEVEN TOOLS OF QUALITY)

1. PARETO DIAGRAM

2. FLOW DIAGRAM

CAUSE AND EFFECT DIAGRAM

STEPS IN CONSTRUCTING A CAUSE & EFFECT DIAGRAM:

a. Define the problem or effect to be analyzed.

b. Form the team to perform the analysis. Often the team will uncover potential causes through brainstorming.

c. Draw the effect box and the centerline.

d. Specify the major potential cause categories and join them as boxes connected to the centerline.
e. Identify the possible causes and classify them into the categories in step d. Create new categories, if necessary.

f. Rank order the causes to identify those that seem most likely to impact the problem.

g. Take corrective action

4. CHECK SHEETS

<table>
<thead>
<tr>
<th>CHECK SHEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product: Bicycle</td>
</tr>
<tr>
<td>Nonconformity Type</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>Blisters</td>
</tr>
<tr>
<td>Light spray</td>
</tr>
<tr>
<td>Drips</td>
</tr>
<tr>
<td>Others</td>
</tr>
<tr>
<td>TOTAL</td>
</tr>
</tbody>
</table>
5. **HISTOGRAM**

<table>
<thead>
<tr>
<th>Number Non-conforming</th>
<th>Tabulation</th>
<th>Freq.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>III III III</td>
<td>15</td>
</tr>
<tr>
<td>1</td>
<td>III III III III</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>III I</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>III</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>III</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>I</td>
<td>1</td>
</tr>
</tbody>
</table>
7. SCATTER DIAGRAM

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

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

NEW MANAGEMENT TOOLS

1. WHY, WHY
2. FORCED FIELD ANALYSIS
   □ Define the objective.
   □ Determine criteria for evaluating the effectiveness of the improvement action.
   □ Brainstorm the forces.
   □ Prioritize the forces from greatest to least.
   □ Take action.

Objective: Stop Smoking

<table>
<thead>
<tr>
<th>PROMOTING FORCES</th>
<th>INHIBITING FORCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor Health</td>
<td>Habit</td>
</tr>
<tr>
<td>Smelly Clothing</td>
<td>Addiction</td>
</tr>
<tr>
<td>Poor Example</td>
<td>Taste</td>
</tr>
<tr>
<td>Cost</td>
<td>Stress</td>
</tr>
<tr>
<td>Impact on Others</td>
<td>Advertisement</td>
</tr>
</tbody>
</table>

3. NOMINAL GROUP TECHNIQUE
STATISTICAL FUNDAMENTALS

Statistics is defined as the science that deals with the collection, tabulation, analysis, interpretation and presentation of quantitative data. Data collected for quality control purposes are obtained by direct observation and are classified as

1. Variables (Measurable quality characteristics like length measured in metres)
2. Attributes (Quality characteristic which are classified as either conforming (or) non-conforming to specifications, such as “go & no-go” gauge.

MEASURES OF CENTRAL TENDENCY AND DISPERSION

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

1. Measures of central tendency.

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

1. Average
2. Median
3. Mode
**Average** is the sum of observations divided by the number of observations.

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

where, \( n \) = number of observations
\( X_i \) = observed value

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

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

- No mode
- Uni mode
- Bi mode
- Multimode

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

The two measures of dispersion are

1. Range
2. Standard Deviation

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

\[
\text{Range} = R = X_h - X_l
\]

Where, \( R \) = Range
\( X_h \) = highest observation in a series
\( X_l \) = lowest observation in a series

**Standard Deviation** measures the spreading tendency of the data. Larger the standard deviation, greater the variability of data.
In order to construct a frequency distribution of the outer diameter of shafts, a small portion (or) sample is selected to represent all the shafts. The population is the whole collection of shafts. The population may be an hour's production, a week's production, 10000 pieces and so on.

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

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

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

3. When the required inspection destroys the product.

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

$X$ is for sample average or sample mean.

$\mu$ is for population mean.

$S$ is for sample standard deviation.

$\sigma$ is for population standard deviation.

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

where $S$ = sample standard deviation

$X_i$ = observed value

$n$ = number of observations
NORMAL CURVE

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

![Normal curve tolerance limits](image)

**Figure 3.2 : Normal curve tolerance limits**

CONTROL CHARTS FOR VARIABLES AND ATTRIBUTES

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

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

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

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

**Assignable causes** result in unnatural variations

The sources of variations may be due to

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

All control charts have three basic components.

1. A centre line, usually the mathematical average of all the samples plotted.

2. Upper and Lower Control Limits that define the constraints of common cause variations.

3. Performance data plotted over time.

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

**CONTROL CHART FOR VARIABLES**

1. Mean chart – X chart & Range Chart – R Chart

\[
\overline{X} = \frac{\sum \overline{X}}{N}
\]

Where, \( N \) = Total number of observations.

\[
\overline{R} = \frac{\sum R}{N}
\]

\( n \) = Sample size (for finding out the value of \( A_2 \) and \( D_4 \) and \( D_3 \) from the table)
Control limits for the charts are given by the following equation.

\[
\begin{array}{cccc}

\text{\textbf{X - CHART}} & \text{\textbf{R - CHART}} \\
\hline
CL & = & X & CL & = & R \\
& & \hline \\
UCL \overline{X} & = & \overline{X} + A_2 \cdot R & UCL _R & = & D_4 \cdot R \\
& & \hline \\
LCL \overline{X} & = & \overline{X} - A_2 \cdot R & LCL _R & = & D_3 \cdot R \\
\end{array}
\]

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

\[
\begin{align*}
\text{\textbf{X}} & = \frac{\Sigma X}{N} \\
\text{\textbf{S}} & = \frac{\Sigma S}{N}
\end{align*}
\]

Where, \( N \) = Total number of observations.

\( n \) = Sample size (for finding out the value of \( A_3 \) and \( B_4 \) and \( B_3 \) from the table)

Control limits for the charts are given by the following equation.
### X-CHART

<table>
<thead>
<tr>
<th>CL</th>
<th>=</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>UCL $\bar{X}$</td>
<td>=</td>
<td>$\bar{X} + A_3 \cdot S$</td>
</tr>
</tbody>
</table>

### S-CHART

<table>
<thead>
<tr>
<th>CL</th>
<th>=</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>UCL $S$</td>
<td>=</td>
<td>$B_4 \cdot S$</td>
</tr>
</tbody>
</table>

| LCL $\bar{X}$ | = | $\bar{X} - A_3 \cdot S$ |
| LCL $S$ | = | $B_3 \cdot S$ |

### CONTROL CHART FOR ATTRIBUTES

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

### PROCESS CAPABILITY INDEX ($CP$, $CPK$)

These calculators compute the process capability index which shows the process potential of meeting the specifications. Enter the process parameters and specifications in one of the following tables, depending on whether you have a double-sided or single-sided specification.

### POPULATION AND SAMPLE

- The major use of inferential statistics is to use information from a **sample** to infer something about a **population**.
- A **population** is a collection of data whose properties are analyzed. The population is the complete collection to be studied, it contains *all* subjects of interest.
- A **sample** is a *part* of the population of interest, a sub-collection selected from a population.

Population: the universal set of all objects under study.
Sample: Any subset of the population.

NORMAL CURVE

As discussed in the previous chapter, the normal curve is one of a number of possible models of probability distributions. Because it is widely used and an important theoretical tool, it is given special status as a separate chapter.

The normal curve is not a single curve, rather it is an infinite number of possible curves, all described by the same algebraic expression:

\[
p(X)=\frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(X-\mu)^2}{2\sigma^2}}
\]
THE SIX STEPS TO SIX SIGMA.
STEP #1 - IDENTIFY THE PRODUCT YOU CREATE OR THE SERVICE YOU PROVIDE
In other words ... WHAT DO YOU DO?
STEP #2 - IDENTIFY THE CUSTOMER(S) FOR YOUR PRODUCT OR SERVICE, AND DETERMINE WHAT THEY CONSIDER IMPORTANT I.E. CUSTOMER REQUIREMENTS
In other words ... WHO USES YOUR PRODUCT AND SERVICES?
STEP #3 - IDENTIFY YOUR NEEDS (TO PROVIDE PRODUCT/SERVICE SO THAT IT SATISFIES THE CUSTOMER)
In other words ... WHAT DO YOU NEED TO DO YOUR WORK?
STEP #4 - DEFINE THE PROCESS FOR DOING YOUR WORK
In other words ... HOW DO YOU DO YOUR WORK?
STEP #5 - MISTAKE-PROOF THE PROCESS AND ELIMINATE WASTED EFFORTS USING...
In other words ... HOW CAN YOU DO YOUR WORK BETTER?
Step #6 - Ensure continuous improvement by measuring, analyzing and controlling the improved process using control charts

UNIT- III

STATISTICS PROCESS CONTROL

PART – A (2 MARKS)

1 Define Statistics?

2. What is a measure of central tendency?

3. What is Measures of dispersion?

4. What is a normal curve?

5. What is the use of the control chart?
6. Give the objectives of the attribute charts?

7. Define Six Sigma Problem Solving Method?

8. What are the new seven management tools?

9. Give the seven tools of quality?

10. Give the usage of C&E diagrams?

11. Define Six Sigma?

12. What are the various histogram shapes?

13. Differentiate Population & Sample?

14. Give the sources of variation?

15. Define Run chart?

16. Define Control chart?

17. What are the various patterns of scatter diagrams?

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

19. Give at least five standard formats of matrix diagram?

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

**PART – B**

1. Explain the QC or SPC tools? (16)

2. Explain the Seven Management Tools? (16)

3. Plot the control chart for variables and attributes (16)

4. Explain the concepts of Six Sigma? (16)

**UNIT IV – TQM TOOLS**
BENCHMARKING

- Benchmarking is a systematic method by which organizations can measure themselves against the best industry practices.
- Benchmarking is a systematic search for the best practices, innovative ideas, and highly effective operating procedures.

BENCHMARKING CONCEPT

![Diagram showing the process of benchmarking]

REASONS TO BENCHMARK:
- It is a tool to achieve business and competitive objectives
- It can inspire managers (and Organizations) to compete
- It is time and cost effective
- It constantly scans the external environment to improve the process
- Potential and useful technological breakthroughs can be located and adopted early

PROCESS OF BENCHMARKING

The following six steps contain the core techniques of Benchmarking

1. Decide what to benchmark
Benchmarking can be applied to any business or production process

- The strategy is usually expressed in terms of mission and vision statements
- Best to begin with the mission and critical factors
- Choosing the scope of the Benchmarking study
- Pareto analysis – what process to investigate
- Cause and Effect diagram – for tracing outputs back

2. Understand current performance
- Understand and document the current process
- Those working in the process are the most capable of identifying and correcting problems
- While documenting, it is important to quantify
- Care should be taken during accounting information

3. Plan
- A benchmarking team should be chosen
- Organizations to serve as the benchmark need to be identified
- Time frame should be agreed upon for each of the benchmarking tasks
- There are three types of benchmarking
  a. Internal
  b. Competitive
  c. Process

4. Study Others

Benchmarking studies look for two types of information
- How best the processes are practiced
- Measurable results of these practices

Three techniques for conducting the research are
- Questionnaires
- Site visits
- Focus groups

5. Learn from the data
Answering a series of questions like
• Is there a gap between the organization's performance and the performance of the best-in-class organizations?
• What is the gap? How much is it?
• Why is there a gap? What does the best-in-class do differently that is better?
• If best-in-class practices were adopted, what would be the resulting improvement?
• Benchmarking studies can reveal three different outcomes
  • Negative gap
  • Parity
  • Positive gap

6. Using the findings
The objective is to close the gap. For this
  • Findings must be communicated to the people within the organization
  • Action plans must be developed to implement new processes

Groups that must agree on the change
  • Process owners
  • Upper management

Steps for the development and execution of action plans are
1. Specify tasks
2. Sequence tasks
3. Determine resources needs
4. Establish task schedule
5. Assign responsibility for each task
6. Describe expected results
7. Specify methods for monitoring results

PITFALLS AND CRITICISMS OF BENCHMARKING:

• Idea of copying others
• It is not a cure or a business philosophy
• Some process have to be benchmarked repeatedly
• It is not a substitute for innovation

QUALITY FUNCTION DEPLOYMENT

• Quality Function Deployment is a planning tool used to fulfill
customer expectations.

- Quality Function Deployment focuses on customer expectations or requirements, often referred to as voice of the customer.

QFD TEAM:

There are two types of teams namely

1. Team for designing a new product

3. Team for improving an existing product

BENEFITS OF QFD:

1. Improves Customer satisfaction

   - Creates focus on customer requirements
   - Uses competitive information effectively
   - Prioritizes resources
   - Identifies items that can be acted upon

2. Reduces Implementation Time

   - Decreases midstream design changes
   - Limits post introduction problems
   - Avoids future development redundancies

3. Promotes Team Work
- Based on consensus
- Creates communication
- Identifies actions

4. Provides Documentation

- Documents rationale for design
- Adds structure to the information
- Adapts to changes (a living document)
THE STEPS IN BUILDING A HOUSE OF QUALITY ARE:

Interrelationship Between Technical Descriptors

Technical Descriptors (Voice of the organization)

Customer Requirements (Voice of the customer)

Relationship between Requirements and

Prioritized Customer Requirements

Prioritized Technical Descriptors
1. List Customer Requirements (WHAT"s)

2. List Technical Descriptors (HOW"s)

3. Develop a Relationship Matrix Between WHAT"s and HOW"s

4. Develop an Inter-relationship Matrix between HOW"s

5. Competitive Assessments
   a. Customer Competitive Assessments
   b. Technical Competitive Assessments

6. Develop Prioritized Customer Requirements

7. Develop Prioritized Technical Descriptors

**TAGUCHI’S QUALITY LOSS FUNCTION**

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 \( \tau \).

At \( \tau \), the loss is Rs. 0.

At LSL (or) USL, the loss is Rs. \( A \).

The quadratic loss function is described by the equation \( L = k (y - \tau)^2 \).

Where,

- \( L \) = cost incurred as quality deviates from the target.
- \( y \) = Performance characteristic
- \( \tau \) = target
- \( k \) = Quality loss coefficient.

The loss coefficient is determined by setting \( \Delta = (y - \tau) \), the deviation from the target. When \( \Delta \) is the USL (or) LSL, the loss to the customer of repairing (or) discarding the product is Rs. \( A \).

Thus,

\[
K = A / (y - \tau)^2 = A / \Delta^2
\]
**SMALLER – THE – BETTER:**

The following figure shows the smaller – the – better concepts.
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.

In the Larger – the – better concept, the target value is $\infty$ (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.
TOTAL PRODUCTIVE MAINTENANCE (TPM)

Total Productive Maintenance (TPM) is defined as keeping the running plant and equipment at its highest productive level with the co-operation of all areas of the organization. Predictive and Preventive maintenance are essential to building a foundation for a successful TPM environment. **Predictive Maintenance** is the process of using data and statistical tools to determine when a piece of equipment will fail. **Preventive Maintenance** is the process of periodically performing activities such as lubrication on the equipment to keep it running.

**OBJECTIVES OF TPM:**
1. To maintain and improve equipment capacity.
2. To maintain equipment for life.
3. To use support from all areas of the operation.
4. To encourage input from all employees.
5. To use teams for continuous improvement.

**TPM PHILOSOPHY – CONCEPT OF TPM:**
Total Productive Maintenance (TPM) is an extension of the Total Quality Management (TQM) philosophy to the maintenance function.

**TPM has the following steps:**
1. Management should learn the new philosophy of TPM.
2. Management should promote the new philosophy of TPM.

3. Training should be funded and developed for everyone in the organization.
4. Areas of needed improvement should be identified.

Loss measurements to identify improvement needs are

- Down time losses
5. Performance goals should be formulated.
6. An implementation plan should be developed.
7. Autonomous work groups should be established.

FAILURE MODE AND EFFECTS ANALYSIS
FMEA is an analytical technique that combines the technology and experience of people in identifying foreseeable failure modes of a product or process and planning for its elimination. It is a group of activities comprising the following:
1. Recognize the potential failure of a product or process.
2. Identify actions that eliminate/reduce the potential failure.
3. Document the process.

Two important types of FMEA are
- Design FMEA
- Process FMEA

INTENT OF FMEA:
- Continually measuring the reliability of a machine, product or process.
- To detect the potential product-related failure mode.
- FMEA evaluation to be conducted immediately following the design phase.

BENEFITS OF FMEA:
- Having a systematic review of components failure modes to ensure that any failure produces minimal damage.
- Determining the effects of any failure on other items.
- Providing input data for exchange studies.
- Determining how the high-failure rate components can be adapted to high-reliability components.
- Eliminating/minimizing the adverse effects that failures could generate.
- Helping uncover the misjudgements, errors etc.
- Reduce development time and cost of manufacturing.

FMEA TEAM:
Engineers from
- Assembly - Manufacturing - Materials - Quality - Service - Supplier - Customer

FMEA DOCUMENTATION:
The purpose of FMEA documentation is
- To allow all involved Engineers to have access to others thoughts
TQM TOOLS

PART – A (2 MARKS)
1. Define Benchmarking?
2. Enumerate the steps to benchmark?
3. What are the types of benchmarking?
4. What is a QFD?
5. What are the benefits of QFD?
6. What are the steps required to construct an affinity diagram?
7. What are the parts of house of quality?
8. How will you build a house of quality?
9. Define FMEA?
10. What are the stages of FMEA?
11. What are the goals of TPM?
12. Give the seven basic steps to get an organization started toward TPM?
13. What are the major loss areas?
14. What are the generic steps for the development and execution of action plans in benchmarking?
15. What are the phases of QFD process?
16. What are the several types of FMEA?

PART – B
1. Explain the Benchmarking Process and reasons to benchmark? (16)
2. Explain the QFD process? (16)
3. Explain the House of Quality in Quality Function Deployment? (16)
4. What is FMEA? Explain the stages of FMEA? (16)
ISO 9000

ISO 9001

ISO 9002

ISO 9003
ISO 9001
Design, Development, Production, Installation & Servicing

ISO 9002
Production, Installation & Servicing

ISO 9003
Inspection & Testing

ISO 9004
Provides guidelines on the technical, administrative and human factors affecting the product or services
ISO 9000: 2000 Sector Standard

**BENEFITS OF ISO 9000 STANDARDS:**

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

CLAUSES (ELEMENTS) OF ISO 9000 (DURING THE YEAR 1987)
4.1 Management Responsibility
- Adequate resources for the verification activities
- Need for trained personnel
- Work and verification activities including audits
- A Management Representative to be identified
4.2 Quality System

4.3 Contract review

4.4 Design Control

4.5 Documents Control

4.6 Purchasing

4.7 Purchaser – Supplied

4.8 Product Identification and Traceability

4.9 Process Control

4.10 Inspection and Testing

4.11 Inspection Measuring and Test Equipment

4.12 Inspection and Test Status

4.13 Control of Non-Conforming Product

4.14 Corrective Action

4.15 Handling, Storage, Packaging and Delivery

4.16 Quality Records

4.17 Internal Quality Audits

4.18 Training

4.19 Servicing

4.20 Statistical Techniques
CLAUSES (ELEMENTS) OF ISO 9000 (During the year 2000)

1. Scope

2. Normative Reference

3. Terms and Definitions

4. Quality Management System (QMS)
   General Requirements
   Documentation

5. Management Responsibility
   Management Commitment
   Customer Focus
   Quality Policy
   Planning
   Responsibility, Authority and Communication
   Management Review

6. Resource Management
   Provision of Resources
   Human Resources
   Infrastructure
   Work Environment

7. Product Realization
   Planning of Product Realization
   Customer related processes
   Design and Development
Purchasing

Production and Service Provision

Control of Monitoring and Measuring devices
8. Monitoring and Measurement
General

Monitoring and Measurement

Control of Non-Conforming Product

Analysis of Data

Improvement

**IMPLEMENTATION OF QUALITY MANAGEMENT SYSTEM:**
1. Top Management Commitment

2. Appoint the Management Representative

3. Awareness

4. Appoint an Implementation Team

5. Training

6. Time Schedule

7. Select Element Owners

8. Review the Present System

9. Write the Documents

10. Install the New System

11. Internal Audit

12. Management Review

13. Pre-assessment

14. Registration

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

**DOCUMENTATION**
In every organization, the quality system must be documented properly. The documentation of the system can be seen as a hierarchical format as shown.
QUALITY AUDITING
The term Audit refers to a regular examination and checking of accounts or financial records, settlement or adjustment of accounts. It also refers to checking, inspection and examination of Production Processes.

PURPOSE OF QUALITY AUDIT:
- To establish the adequacy of the system.
- To determine the effectiveness of the system.
- To afford opportunities for system analysis.
- To help in problem solving.
- To make decision making easier etc.
TYPES OF QUALITY AUDIT:
1. First – Party Audit.
3. Third – Party Audit.

Quality audit can also be classified on the basis of the area taken into account for the audit such as
- System Audit.
- Process Audit.
- Product Audit.
- Adequacy Audit.
- Compliance Audit.
The overall aim of the Environmental Management systems is to provide protection to the environment and to prevent pollution. The success of ISO 9000 along with increased emphasis on Environmental issues were instrumental in ISO’s decision to develop Environmental Management Standards.


Mission of TC207 is to develop standards for an Environmental Management System (EMS) which was identified as ISO 14000.

TC 207 has established six sub-committees:
1. Environmental Management System (EMS)
2. Environmental Auditing (EA)
3. Environmental labeling (EL)
4. Environmental Performance Evaluation (EPE)
5. Life-Cycle Assessment (LCA)
6. Terms & Definitions
Environmental Management System (EMS):
EMS has two Evaluation Standards. They are

REQUIREMENT OF ISO 14001
There are six elements
1. GENERAL REQUIREMENTS

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

2. ENVIRONMENTAL POLICY (Should be based on mission)

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

3. PLANNING

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

4. IMPLEMENTATION & OPERATION

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

5. CHECKING & CORRECTIVE ACTION

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

6. MANAGEMENT REVIEW

☐ Review of objectives & targets
☐ Review of Environmental performance against legal & other requirement
☐ Effectiveness of EMS elements
☐ Evaluation of the continuation of the policy
BENEFITS OF ENVIRONMENTAL MANAGEMENT SYSTEM:

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

ORGANIZATIONAL BENEFITS
- Assuring customers of a commitment to environmental management
- Meeting customer requirement
- Improve public relation
- Increase investor satisfaction
- Market share increase
- Conserving input material & energy
- Better industry/government relation
- Low cost insurance, easy attainment of permits & authorization
UNIT- V
QUALITY SYSTEMS
PART – A (2 MARKS)
1. Give the ISO 9000 Series of Standards?
2. What is the need for ISO 9000?
3. Give some other quality systems?
4. Give the objectives of the internal audit?
5. What are the requirements of ISO 14001?
6. What are the benefits of ISO 14000?
7. What are the four elements for the checking & corrective action of ISO 14001?
8. What are the seven elements for the implementation & operations of ISO 14001?
9. What are the four elements for the planning of ISO 14001?
10. Give the types of Organizational Evaluation Standards?
11. Give the types of Product Evaluation Standards?
12. Define Quality Audits?
13. Analyze TQM?
14. What are the benefits of ISO?
15. Give the ISO 9001 requirements?
16. What are the methods of actual audit?
1. Explain the elements of ISO 9000:2000? (16)
2. Explain the implementation and documentation of Quality System? (16)
3. Explain the requirements of ISO 14000? (16)
4. Explain the Benefits of ISO 14000? (16)
6. Why is ISO 9000 important? Explain briefly. (16)

TWO MARK QUESTIONS-ANSWERS
1. Define Total Quality?
TQM is a enhancement to the traditional way of doing business. It is the art of managing the whole to achieve excellence. It is defined both a philosophy and a set of guiding principles that represent the foundation of a continuously improving organization. It is the application of quantitative methods and human resources to improve all the processes within an organization and exceed customer needs now and in the future. It integrates fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach.

2. Define Quality?
Quality = Performance x Expectations

3. What are the Dimensions of Quality?
- Performance
- Features
- Conformance
- Reliability
- Durability
- Service
- Response
- Aesthetics
- Reputation

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

5. State Deming Philosophy?
- Create and publish the aims and purposes of the organization.
- Learn the new philosophy.
- Understand the purpose of inspection.
- Stop awarding business based on price alone.
- Improve constantly and forever the system.
- Institute training.
- Teach and institute leadership.
  _ - Drive out fear, Create trust and Create a climate for innovation.
  _ - Optimize the efforts of teams, groups and staff areas.
- Eliminate exhortations for the work force.
- Eliminate numerical quotes for the work force.
  _ - Eliminate management by objective.
  _ - Remove barriers that rob people of pride of workmanship.
- Encourage education and self-improvement for everyone.
- Take action for accomplish the transformation.

6. Give the Principles of TQM?
1. Constancy of purpose: short range and long range objectives aligned
2. Identify the customer(s); Customer orientation
3. Identification of internal and external customers
4. Continuous improvement
5. Workflow as customer transactions
6. Empower front-line worker as leader
7. Quality is everybody’’s business
8. For a service industry, some elements of quality are:
   - empathy
   - trust; i.e. expertise, integrity, courtesy
   - responsiveness
   - tangible product attractiveness (curb appeal)
   - reliability, on time, no interruptions
9. Customer orientation to child care services, a marketing perspective
10. Barriers that exist to a customer orientation
11. How do we find out what customers want?
12. Present Art Emlen findings on flexibility

7. Give the Obstacles associated with TQM Implementation?
   _ - Lack of management commitment
   _ - Inability to change organizational culture
   - Improper planning
- Lack of continuous training and education
- Incompatible organizational structure and isolated individuals and departments
- Ineffective measurement techniques and lack of access to data and results.
- Paying inadequate attention to internal and external customers.
- Inadequate use of empowerment and teamwork.

8. Give the Analysis Techniques for Quality Costs?
   i. Trend Analysis
   ii. Pareto Analysis

9. Define Quality Costs?
   Quality Costs are defined as those costs associated with the nonachievement of product or service quality as defined by the requirements established by the organization and its contracts with customers and society.

10. Give the primary categories of Quality cost?
    i. Preventive cost category
    ii. Appraisal cost category
    iii. Internal failure cost category
    iv. External failure cost category

11. Give the sub-elements of Preventive cost category?
    i. Marketing/Customer/User
    ii. Product/Service/Design development
    iii. Purchasing
    iv. Operations/
    v. Quality Administration
    vi. Other Prevention Costs

12. Give the sub-elements of Appraisal cost category?
    i. Purchasing appraisal cost
    ii. Operations appraisal cost
    iii. External appraisal cost
    iv. Review of test and application data
    v. Miscellaneous quality evaluations

13. Give the sub-elements of Internal failure cost category?
    i. Product or Service Design costs (Internal)
    ii. Purchasing failure costs
    iii. Operations failure costs

14. Give the sub-elements of External failure cost category?
i. Complaint investigations of customer or user service
ii. Returned goods
iii. Retrofit and recall costs
iv. Warranty claims
v. Liability costs
vi. Penalties
vii. Customer or user goodwill
viii. Lost sales
ix. Other external failure costs

15. **Give the typical cost bases?**
   i. Labor
   ii. Production
   iii. Unit
   iv. Sales

16. **How will you determine the optimum cost?**
   a. Make comparison with other organizations
   b. Optimize the individual categories
   c. Analyze the relationships among the cost categories

17. **State the Quality Improvement Strategy?**
   - Reduce failure costs by problem solving
   - Invest in the “right” prevention activities
   - Reduce appraisal costs where appropriate and in a statistically sound manner
   - Continuously evaluate and redirect the prevention effort to gain further quality improvement.

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

19. **Give the Objectives of TQM?**
   a. To develop a conceptual understanding of the basic principles and methods associated with TQM;
   b. To develop an understanding of how these principles and methods have been put into effect in a variety of organizations;
c. To develop an understanding of the relationship between TQM principles and the theories and models studied in traditional management;

d. To do the right things, **right** the first time, every time.

**20. Give the Quality Hierarchy?**

1. Inspection
2. Quality Control (QC)
3. Quality Assurance (QA)
4. Total Quality Management

Inspect products.
Detection
Finding &
Fixing Mistakes.

**21. What is needed for a leader to be effective?**

To be effective, a leader needs to know and understand the following:

- People, paradoxically, need security and independence at the same time.
- People are sensitive to external rewards and punishments and yet are also strongly self-motivated.
- People like to hear a kind word of praise.
- People can process only a few facts at a time; thus, a leader needs to keep things simple.
- People trust their gut reaction more than statistical data.
- People distrust a leader’s rhetoric if the words are inconsistent with the leader’s actions.

**22. What is the important role of senior management?**

- Listening to internal and external customers and suppliers through visits, focus groups and surveys.
- Communication.
- To drive fear out of the organization, break down barriers, remove system roadblocks, anticipate and minimize resistance to change and in general, change the culture.

**23. What are the general duties of a quality council?**

i. Develop, with input from all personnel, the core values, vision statement, mission statement, and quality policy statement.

ii. Develop the strategic long-term plan with goals and the annual quality
improve an improvement program with objectives.

iii. Create the total education and training plan.

iv. Determine and continually monitor the cost of poor quality.

v. Determine the performance measures for the organization, approve those for the functional areas, and monitor them.

vi. Continually, determine those projects that improve the processes, particularly those that affect external and internal customer satisfaction.

vii. Establish multifunctional project and departmental or work group teams and monitor their progress.

viii. Establish or revise the recognition and reward system to account for the new way of doing business.

24. What does a typical meeting agenda contain after establishing the TQM?

- Progress report on teams
- Customer satisfaction report
- Progress on meeting goals
- New project teams
- Recognition dinner
- Benchmarking report

25. What are the various quality statements?

- Vision Statement
- Mission Statement
- Quality Policy Statement

26. Give the basic steps to strategic quality planning?

i. Customer needs

ii. Customer positioning

iii. Predict the future

iv. Gap analysis

v. Closing the gap

vi. Alignment

vii. Implementation

27. What is a quality policy?

The Quality Policy is a guide for everyone in the organization as to how they should provide products and service to the customers. The common characteristics are

- Quality is first among equals.
Meet the needs of the internal and external customers.
Equal or exceed the competition.
Continually improve the quality.
Include business and production practices.
Utilize the entire work force.

28. **What is a mission statement?**
The mission statement answers the following questions: who we are, who are the customers, what we do, and how we do it.

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

30. **What are the important factors that influenced purchases?**
i. Performance
ii. Features
iii. Service
iv. Warranty
v. Price
vi. Reputation

31. **Give the need for a feedback in an organization?**
   - Discover customer dissatisfaction.
   - Discover relative priorities of quality.
   - Compare performance with the competition.
   - Identify customer’s needs.
   - Determine opportunities for improvement.

32. **List the tools used for feedback?**
A Comment cards
A Surveys
A Focus groups
A Toll-free telephone lines
A Customer visits
A Report cards
A The internet
A Employee feedback
A American Customer Satisfaction Index
33. What are the activities to be done using customer complaints?

# Investigate customer’s experience by actively soliciting feedback, both positive and negative, and then acting on it promptly.
# Develop procedures for complaint resolution that include empowering front-line personnel.
# Analyze complaints, but understand that complaints that do not always fit into neat categories.
# Work to identify process and material variations and then eliminate the root cause. “More inspection” is not corrective action.
# When a survey response is received, a senior manager should contact the customer and strive to resolve the concern.
# Establish customer satisfaction measures and constantly monitor them.
# Communicate complaint information, as well as the results of all investigations and solutions, to all people in the organization.
# Provide a monthly complain report to the quality council for their evaluation and, if needed, the assignment of process improvement teams.
# Identify customer’s expectations beforehand rather than afterward through complaint analysis.

34. What are the elements of customer service?

" Organization
" Customer care
" Communication
" Front-line people
" Leadership

35. Define customer retention?

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

36. Define Employee Involvement?

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

37. State Maslow’s Hierarchy of Needs?
Level 1 : Survival
Level 2 : Security
Level 3 : Social
Level 4 : Esteem
Level 5 : Self-actualization

38. State Frederick Herzberg’s Two-factor theory?
Herzberg found that people were motivated by recognition, responsibility, achievement and the work itself.

39. What does an employee want?
   i. Interesting work
   ii. Appreciation
   iii. Involvement
   iv. Job security
   v. Good pay
   vi. Promotion/growth
   vii. Good working conditions
   viii. Loyalty to employees
   ix. Help with personal problems
   x. Tactful discipline

40. What are the concepts to achieve a motivated work force?
   a. Know thyself
   b. Know your employees
   c. Establish a positive attitude
   d. Share the goals
   e. Monitor progress
   f. Develop interesting work
   g. Communicate effectively
   h. Celebrate success

41. Define Empowerment?
Empowerment means invest people with authority. Its purpose is to tap the enormous reservoir of creativity and potential contribution that lies within every worker at all levels.

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

42. **What are the three conditions necessary to create the empowered environment?**
   i. Everyone must understand the need for change.
   ii. The system needs to change for the new paradigm
   iii. The organization must enable its employees

43. **What are the types of teams?**
   i. Process improvement team
   ii. Cross-functional team
   iii. Natural work teams
   iv. Self-directed/self-managed work teams

44. **What are the characteristics of successful teams?**
   a. Sponsor
   b. Team charter
   c. Team composition
   d. Training
   e. Ground rules
   f. Clear objectives
   g. Accountability
   h. Well-defined decision procedures
   i. Resources
   j. Trust
   k. Effective problem solving
   l. Open communications
   m. Appropriate leadership
   n. Balanced participation
   o. Cohesiveness

45. **What are the decision-making methods?**
   a) Nondecision
   b) Unilateral decision
   c) Handclasp decision
   d) Minority-rule decision
   e) Majority-rule decision
   f) Consensus

46. **What are the stages of team development?**
i. Forming  
ii. Storming  
iii. Norming  
iv. Performing  
v. Adjourning  

47. **Give some common team problems?**  
I. Floundering  
II. Overbearing participants  
III. Dominating participants  
IV. Reluctant participants  
V. Unquestioned acceptance of opinions as facts  
VI. Rush to accomplish  
VII. Attribution  
VIII. Discounts and “plops”  
IX. Wanderlust: digression and tangents  
X. Feuding team members  

48. **What are the common barriers to team progress?**  
i. Insufficient training  
ii. Incompatible rewards and compensation  
iii. First-line supervisor resistance  
iv. Lack of planning  
v. Lack of management support  
vi. Access to information systems  
vii. Lack of union support  

49. **Give the steps involved in training process?**  
1st. Make everyone aware of what the training is all about.  
2nd. Get acceptance.  
3rd. Adapt the program.  
4th. Adapt to what has been agreed upon.  

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

51. **What are the types of appraisal formats?**
   i. Ranking
   ii. Narrative
   iii. Graphic
   iv. Forced choice

52. **What are the benefits of employee involvement?**
   Employee Involvement improves quality and increases productivity because
   - Employees make better decisions using their expert knowledge of the process.
   - Employees are more likely to implement and support decisions they had a part in making.
   - Employees are better able to spot and pinpoint areas for improvement.
   - Employees are better able to take immediate corrective action.
   - Employee involvement reduces labor/management hassle by more effective communications and cooperation.
   - Employee involvement increases morale by creating a feeling of belonging to the organization.
   - Employees are better able to accept change because they control the work environment.
   - Employees have an increased commitment to unit goals because they are involved.

53. **What are the basic ways for a continuous process improvement?**
   - Reduce resources
   - Reduce errors
   - Meet or exceed expectations of downstream customers
   - Make the process safer
   - Make the process more satisfying to the person doing it.

54. **What are the three components of the Juran Trilogy?**
   i. Planning
   ii. Control
   iii. Improvement

55. **What are the steps in the PDSA cycle?**
   The basic Plan-Do-Study-Act is an effective improvement technique.
   1st. Plan carefully what is to be done
   2nd. Carry out the plan
   3rd. Study the results
4th. Act on the results by identifying what worked as planned and what didn”t.

56. What are the phases of a Continuous Process Improvement Cycle?
   a) Identify the opportunity
   b) Analyze the process
   c) Develop the optimal solutions
   d) Implement
   e) Study the results
   f) Standardize the solution
   g) Plan for the future

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

Sort – (Seiri) the first S focuses on eliminating unnecessary items from the workplace.
Set In Order (Seiton) is the second of the 5Ss and focuses on efficient and effective storage methods.
Shine: (Seiso) Once you have eliminated the clutter and junk that has been clogging your work areas and identified and located the necessary items, the next step is to thoroughly clean the work area.
Standardize: (Seiketsu) Once the first three 5S”s have been implemented, you should concentrate on standardizing best practice in your work area.
Sustain: (Shitsuke) This is by far the most difficult S to implement and achieve.
Once fully implemented, the 5S process can increase morale, create positive impressions on customers, and increase efficiency and organization.

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

59. What are the three key elements to a partnering relationship?
   i. Long-term commitment
   ii. Trust
iii. Shared vision

60. **What are the three types of sourcing?**
   a) Sole sourcing
   b) Multiple sourcing
   c) Single sourcing

61. **What are the ten conditions for the selection and evaluation of suppliers?**
   I. The supplier understands and appreciates the management philosophy of the organization.
   II. The supplier has a stable management system.
   III. The supplier maintains high technical standards and has the capability of dealing with future technological innovations.
   IV. The supplier can supply precisely those raw materials and parts required by the purchaser, and those supplied meet the quality specifications.
   V. The supplier has the capability to produce the amount of production needed or can attain that capability.
   VI. There is no danger of the supplier breaching corporate secrets.
   VII. The price is right and the delivery dates can be met. In addition, the supplier is easily accessible in terms of transportation and communication.
   VIII. The supplier is sincere in implementing the contract provisions.
   IX. The supplier has an effective quality system and improvement program such as ISO/QS 9000.
   X. The supplier has a track record of customer satisfaction and organization credibility.

62. **What are the four phases of inspection?**
   i. 100% inspection
   ii. Sampling
   iii. Audit
   iv. Identity check

63. **What are the objectives of Performance measures?**
   i. Establish baseline measures and reveal trends.
   ii. Determine which processes need to be improved.
   iii. Indicate process gains and losses.
   iv. Compare goals with actual performance.
   v. Provide information for individual and team evaluation.
   vi. Provide information to make informed decisions.
vii. Determine the overall performance of the organization.

64. What are the characteristics used to measure the performance of a particular process?
i. Quantity
ii. Cost
iii. Time
iv. Accuracy
v. Function
vi. Service
vii. Aesthetics

65. Give the six basic techniques for presenting performance measures?
a) Time series graph
b) Control chart
c) Capability index
d) Taguchi’s Loss Function
e) Cost of poor quality
f) Malcolm Baldrige National Quality Award

66. Give the seven tools of quality?
i. Pareto Diagram
ii. Process Flow Diagram
iii. Cause-and-Effect Diagram
iv. Check Sheets
v. Histogram
vi. Control Charts
vii. Scatter Diagrams

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

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

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

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

71. **What is the use of the control chart?**
The control chart is used to keep a continuing record of a particular quality characteristic. It is a picture of process over time.

72. **Give the objectives of the attribute charts?**
i. Determine the average quality level.
ii. Bring to the attention of management any changes in the average.
iii. Improve the product quality.
iv. Evaluate the quality performance of operating and management personnel.
v. Determine acceptance criteria of a product before shipment to the customer.

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

74. **What are the new seven management tools?**
i. Affinity Diagram
ii. Interrelationship Digraph
iii. Tree Diagram
iv. Matrix Diagram
v. Prioritization Matrices
vi. Process Decision Program Chart
vii. Activity Network diagram

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

76. **Enumerate the steps to benchmark?**
   a) Decide what to benchmark
   b) Understand current performance
   c) Plan
   d) Study others
   e) Learn from the data
   f) Use the findings

77. **What are the types of benchmarking?**
   i. Internal
   ii. Competitive
   iii. Process

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

79. **What are the benefits of QFD?**
   i. Customer driven
   ii. Reduces implementation time
   iii. Promotes teamwork
   iv. Provides documentation

80. **What are the steps required to construct an affinity diagram?**
   i. Phrase the objective
   ii. Record all responses
   iii. Group the responses
   iv. Organize groups in an affinity diagram

81. **What are the parts of house of quality?**
   i. Customer requirements
   ii. Prioritized customer requirements
   iii. Technical descriptors
   iv. Prioritized technical descriptors
   v. Relationship between requirements and descriptors
   vi. Interrelationship between technical descriptors

82. **How will you build a house of quality?**
a) List customer requirements
b) List technical descriptors
c) Develop a relationship matrix between WHATs and HOWs
d) Develop an interrelationship matrix between HOWs
e) Competitive assessments
f) Develop prioritized customer requirements
g) Develop prioritized technical descriptors

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

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

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

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

a) Management learns the new philosophy  
b) Management promotes the new philosophy  
c) Training is funded and developed for everyone in the organization  
d) Areas of needed improvement are identified  
e) Performance goals are formulated  
f) An implementation plan is developed  
g) Autonomous work groups are established

87. **What are the major loss areas?**

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

88. **Give the ISO 9000 Series of Standards?**

i. ISO 9000, “Quality Management and Quality Assurance Standards Guidelines for Selection and Use”.


89. **What is the need for ISO 9000?**

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

90. **Give some other quality systems?**

i. QS-9000
91. Enumerate the steps necessary to implement the Quality Management System?
   i. Senior management commitment
   ii. Appoint the management representative
   iii. Awareness
   iv. Appoint an implementation team
   v. Training
   vi. Time schedule
   vii. Select element owners
   viii. Review the present system
   ix. Write the documents
   x. Install the new system
   xi. Internal audit
   xii. Management review
   xiii. Preassessment
   xiv. Registration

92. What are the three sections of QS-9000?
   i. Common requirements, which include the exact text of ISO 9001 and the addition of automotive/heavy trucking requirements.
   ii. Additional requirements covering production part approval process, continuous improvement and manufacturing capabilities.
   iii. Customer-specific requirements.

93. What are the ISO/QS 9000 elements?
   i. Management responsibility
   ii. The Quality system
   iii. Contract review
   iv. Design control
   v. Document and data control
vi. Purchasing
vii. Control of customer-supplied product
viii. Product identification and traceability
ix. Process control
x. Inspection and testing
xi. Control of inspection, measuring and test equipment
xii. Inspection and test status
xiii. Control of nonconforming product
xiv. Corrective and preventive action
xv. Handling, storage, packaging, preservation and delivery
xvi. Control of quality records
xvii. Internal quality audits
xviii. Training
xix. Servicing
xx. Statistical techniques

94. **Give the objectives of the internal audit?**
   
a) Determine the actual performance conforms to the documented quality systems.
b) Initiate corrective action activities in response to deficiencies.
c) Follow up on noncompliance items of previous audits.
d) Provide continued improvement in the system through feedback to management.
e) Cause the auditee to think about the process, thereby creating possible improvements.

95. **What are the requirements of ISO 14001?**
   
i. General requirements
ii. Environmental policy
iii. Planning
iv. Implementation and operation
v. Checking and corrective action
vi. Management review

96. **What are the benefits of ISO 14000?**
   
a. Global
   
i. Facilitate trade and remove trade barriers
   
ii. Improve environmental performance of planet earth
iii. Build consensus that there is a need for environment management and a common terminology for EMS.
b. Organizational
i. Assuring customers of a commitment to environmental management
ii. Meeting customer requirements
iii. Maintaining a good public / community relations image
iv. Satisfying investor criteria and improving access to capital
v. Obtaining insurance at reasonable cost
vi. Increasing market share that results from a competitive advantage
vii. Reducing incidents that result in liability
viii. Improving defense posture in litigation
ix. Conserving input materials and energy
x. Facilitating the attainment of permits and authorization
xi. Improving industry/government relations

97. What are the four elements for the checking
98. What are the seven elements for the implementation & operations of ISO 14001?

97. What are the four elements for the checking & corrective action of ISO 14001?
a) Monitoring and measuring
b) Nonconformance and corrective and preventative action
c) Records
d) EMS audit

98. What are the seven elements for the implementation & operations of ISO 14001?
a) Structure and responsibility
b) Training, awareness and competency
c) Communication
d) EMS documentation
e) Documentation control
f) Operational control
g) Emergency preparedness and response

99. What are the four elements for the planning of ISO 14001?
a) Environmental aspects
b) Legal and other requirements
c) Objectives and targets
d) Environmental Management Programs

100. Give the types of Organizational Evaluation Standards?
i. Environmental Management System
ii. Environmental Auditing
iii. Environmental Performance Evaluation

101. Give the types of Product Evaluation Standards?
i. Environmental Aspects in Product Standards
ii. Environmental Labeling
iii. Life-Cycle Assessment

102. Discuss about ISO 9000:2000 Quality Systems?
ISO's purpose is to facilitate international trade by providing a single set of standards that people everywhere would recognize and respect.
The ISO 9000 2000 Standards apply to all kinds of organizations in all kinds of areas. Some of these areas include manufacturing, processing, servicing, printing etc

103. Why is ISO 9000 important?
1 Focus on your customers Organizations rely on customers. Therefore:
- Organizations must understand customer needs.
- Organizations must meet customer requirements.
- Organizations must exceed customer expectations.
2 Provide leadership Organizations rely on leaders. Therefore:
- Leaders must establish a unity of purpose and set the direction the organization should take.
- Leaders must create an environment that encourages people to achieve the organization's objectives.
3 Involve your people Organizations rely on people. Therefore:
- Organizations must encourage the involvement of people at all levels.
- Organizations must help people to develop and use their abilities.
4 Use a process approach Organizations are more efficient and effective
when they use a process approach. Therefore:
- Organizations must use a process approach to manage activities and related resources.

5 Take a systems approach Organizations are more efficient and effective when they use a systems approach. Therefore:
- Organizations must identify interrelated processes and treat them as a system.
- Organizations must use a systems approach to manage their interrelated processes.

6 Encourage continual improvement Organizations are more efficient and effective when they continually try to improve. Therefore:
- Organizations must make a permanent commitment to continually improve their overall performance.

7 Get the facts Organizations perform better when their decisions are based on facts. Therefore:
- Organizations must base decisions on the analysis of factual information and data.

8 Work with your suppliers Organizations depend on their suppliers to help them create value. Therefore:
Organizations must maintain a mutually beneficial relationship with their suppliers.

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

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

106. Give the usage of an effective recognition and reward system?
-Serves as a continual reminder that the organization regards quality and productivity as important.
-Offers the organization a visible technique to thank high achievers for outstanding performance.
- Provides employees a specific goal to work toward. It motivates them to improve the process.
- Boosts morale in the work environment by creating a healthy sense of competition among individuals and teams seeking recognition.

**107. How will you improve the performance appraisal system?**

- Use rating scales that have few rating categories.
- Require work team or group evaluations that are at least equal in emphasis to individual-focused evaluations.
- Require more frequent performance reviews where such reviews will have a dominant emphasis on future planning.
- Promotion decisions should be made by an independent administrative process that draws on current-job information and potential for the new job.
- Include indexes of external customer satisfaction in the appraisal process.
- Use peer and subordinate feedback as an index of internal customer satisfaction.
- Include evaluation for process improvement in addition to results.

**108. What are the typical measurements frequently asked by managers and teams?**

- Human Resource
- Customers
- Production
- Research & Development
- Suppliers
- Marketing/Sales
- Administration

**109. What are the criteria to evaluate the performance measures?**

- Simple
- Few in number
- Developed by users
- Relevance to customer
- Improvement
- Cost
- Visible
- Timely
- Aligned
Results

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

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

112. **What are the various histogram shapes?**
- Symmetrical
- Skewed right
- Skewed left
- Peaked
- Flat
- Bimodal
- Plateau distribution
- Comb distribution
- Double peaked distribution

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

114. **Give the sources of variation?**
- Equipment
- Material
- Environment
- Operator

115. **Define Run chart?**
A run chart is a very simple technique for analyzing the process in the development stage or, for that matter, when other charting techniques are not applicable.
116. Define Control chart?
Control chart is a means of visualizing the variations that occur in the central tendency and the dispersion of a set of observations. It is a graphical record of the quality of a particular characteristic.

117. What are the various patterns of scatter diagrams?
- Positive correlation
- Negative correlation
- No correlation
- Negative correlation may exist
- Correlation by stratification
- Curvilinear relationship

118. What is the procedure for constructing the tree diagram?
- Choose an action-oriented objective statement from the interrelationship diagram, affinity diagram, brainstorming, team mission statement, and so forth.
- Using brainstorming, choose the major headings.
- Generate the next level by analyzing the major headings.

119. Give at least five standard formats of matrix diagram?
- L-shaped
- T-shaped
- Y-shaped
- C-shaped
- X-shaped

120. What are the benefits of an activity network diagram?
- A realistic timetable determined by the users.
- Team members understand the role in the overall plan.
- Bottlenecks can be discovered and corrective action taken.
- Members focus on the critical tasks.

121. What are the generic steps for the development and execution of action plans in benchmarking?
- Specify tasks.
- Sequence tasks.
- Determine resource needs.
- Establish task schedule.
- Assign responsibility for each task.
- Describe expected results.
Specify methods for monitoring results.

**122. What are the phases of QFD process?**

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

**123. What are the several types of FMEA?**

- Design FMEA  
- Process FMEA  
- Equipment FMEA  
- Maintenance FMEA  
- Concept FMEA  
- Service FMEA  
- System FMEA  
- Environment FMEA etc

**124. What does a Design FMEA document contain?**

- FMEA Number  
- Item  
- Design Responsibility  
- Prepared By  
- Model Number / Year  
- Key Date  
- Fmea Date  
- Core Team  
- Item / Function  
- Potential Failure Mode  
- Potential Effects of Failure  
- Severity  
- Classification  
- Potential Causes / Mechanisms of Failure  
- Occurrence  
- Current Design Controls  
- Detection  
- Risk Priority Number
125. What does a Process FMEA document contains?
- Process Function / Requirements
- Potential Failure Mode
- Potential Effects of Failure
- Severity
- Classification
- Potential Causes / Mechanisms of Failure
- Occurrence
- Current Process Controls
- Detection

126. Define TPM?
T : Total = All encompassing by maintenance and production individuals working together.
P : Productive = Production of goods and services that meet or exceed customer”s expectations.
M : Maintenance = Keeping equipment and plant in as good as or better than the original condition at all times.

127. What are the benefits of ISO?
- 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.

128. Give the ISO 9001 requirements?
- Scope
- Normative Reference
- Terms and Definitions
- Quality Management System
- Management Responsibility
- Resource Management
- Product Realization
- Measurement, Analysis & Improvement

129. What are the methods of actual audit?
  i. Examination of documents
  ii. Observation of activities
  iii. Interviews

16 Mark Questions

1. Explain the Dimensions of Quality?
  - Performance
  - Features
  - Conformance
  - Reliability
  - Durability
  - Service
  - Response
  - Aesthetics
  - Reputation

2. Explain Deming Philosophy?
  - Create and publish the aims and purposes of the organization.
  - Learn the new philosophy.
  - Understand the purpose of inspection.
  - Stop awarding business based on price alone.
  - Improve constantly and forever the system.
  - Institute training.
  - Teach and institute leadership.
  - Drive out fear, Create trust and Create a climate for innovation.
- Optimize the efforts of teams, groups and staff areas.
- Eliminate exhortations for the work force.
- Eliminate numerical quotes for the work force.
- Eliminate management by objective.
- Remove barriers that rob people of pride of workmanship.

3. **Explain the Analysis Techniques for Quality Costs?**
   i. Trend Analysis
   ii. Pareto Analysis

4. **Describe the primary categories of Quality cost?**
   i. Preventive cost category
   ii. Appraisal cost category
   iii. Internal failure cost category
   iv. External failure cost category

5. **Explain the important role of senior management?**
   - Listening to internal and external customers and suppliers through visits, focus groups and surveys.
   - Communication.
   - To drive fear out of the organization, break down barriers, remove system roadblocks, anticipate and minimize resistance to change and in general, change the culture.

6. **Explain the various quality statements?**
   Vision Statement
   Mission Statement
   Quality Policy Statement

7. **Discuss the basic steps to strategic quality planning?**
   i. Customer needs
   ii. Customer positioning
   iii. Predict the future
   iv. Gap analysis
   v. Closing the gap
   vi. Alignment
   vii. Implementation

8. **Explain the elements of customer service?**
   " Organization
   " Customer care
9. Explain Maslow’s Hierarchy of Needs?
Level 1 : Survival
Level 2 : Security
Level 3 : Social
Level 4 : Esteem
Level 5 : Self-actualization

10. Explain the types of teams?
   i. Process improvement team
   ii. Cross-functional team
   iii. Natural work teams
   iv. Self-directed/self-managed work teams

11. Explain the characteristics of successful teams?
   a. Sponsor
   b. Team charter
   c. Team composition
   d. Training
   e. Ground rules
   f. Clear objectives
   g. Accountability
   h. Well-defined decision procedures
   i. Resources
   j. Trust
   k. Effective problem solving
   l. Open communications
   m. Appropriate leadership
   n. Balanced participation
   o. Cohesiveness

12. Explain the stages of team development?
   i. Forming
   ii. Storming
   iii. Norming
   iv. Performing
13. Explain the three components of the Juran Trilogy?
   i. Planning
   ii. Control
   iii. Improvement

14. Explain the steps in the PDSA cycle?
The basic Plan-Do-Study-Act is an effective improvement technique.
1st. Plan carefully what is to be done
2nd. Carry out the plan
3rd. Study the results
4th. Act on the results by identifying what worked as planned and what didn’t.

15. Explain the phases of a Continuous Process Improvement Cycle?
   a) Identify the opportunity
   b) Analyze the process
   c) Develop the optimal solutions
   d) Implement
   e) Study the results
   f) Standardize the solution

16. Explain 5S?
   Sort – (Seiri)
   Set In Order (Seiton)
   Shine: (Seiso)
   Standardize: (Seiketsu)
   Sustain: (Shitsuke)

17. Explain the three types of sourcing?
   a) Sole sourcing
   b) Multiple sourcing
   c) Single sourcing

18. Discuss the seven tools of quality?
   i. Pareto Diagram
   ii. Process Flow Diagram
   iii. Cause-and-Effect Diagram
   iv. Check Sheets
v. Histogram  
vi. Control Charts  
vii. Scatter Diagrams  

19. Explain the Six Sigma Problem Solving Method?  
Define  
Measure  
Analyze  
Improve  
Control  

20. What are the new seven management tools?  
i. Affinity Diagram  
ii. Interrelationship Digraph  
iii. Tree Diagram  
iv. Matrix Diagram  
v. Prioritization Matrices
vi. Process Decision Program Chart
vii. Activity Network diagram

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

22. Explain the types of benchmarking?
   i. Internal
   ii. Competitive
   iii. Process

23. Explain the parts of house of quality?
   i. Customer requirements
   ii. Prioritized customer requirements
   iii. Technical descriptors
   iv. Prioritized technical descriptors
   v. Relationship between requirements and descriptors
   vi. Interrelationship between technical descriptors

24. Explain the stages of FMEA?
   1. Specifying possibilities
      a. Functions
      b. Possible failure modes
      c. Root causes
      d. Effects
      e. Detection/Prevention
   2. Quantifying risk
      a. Probability of cause
      b. Severity of effect

25. Explain the steps necessary to implement the Quality Management System?
   i. Senior management commitment
   ii. Appoint the management representative
   iii. Awareness
   iv. Appoint an implementation team
v. Training
vi. Time schedule
vii. Select element owners
viii. Review the present system
ix. Write the documents
x. Install the new system
xi. Internal audit
xii. Management review
xiii. Preassessment
xiv. Registration

26. **Explain the ISO/QS 9000 elements?**

i. Management responsibility

ii. The Quality system

iii. Contract review

iv. Design control

v. Document and data control

vi. Purchasing

vii. Control of customer-supplied product

viii. Product identification and traceability

ix. Process control

x. Inspection and testing

xi. Control of inspection, measuring and test equipment

xii. Inspection and test status
University Question Bank
Model 1
Part A (10 x 2 = 20 Marks)
1. Define Quality as per Ed. Deming?
2. What do you understand by quality statement?
3. Explain: Empowerment?
4. Explain: Supplier selection?
5. List out various measurements of dispersion in SPC?
6. Explain the rules to be followed in sample selection?
7. List down the pillars of TPM?
8. Explain: Taguchi Quality Loss Function?
9. Explain about NCR?
10. Explain the need for the quality systems in an organization?

Part B (5x16=80 Marks)
11. (a).(i) List out the barriers of TPM implementation?[ 8]
(ii). Discuss about the analysis techniques for the quality cost?[ 8]

(or)
(b). (i). Explain the principles of TQM?[ 8] (ii) Explain about the strategic planning?[ 8]

(or)
(b) Discuss about Maslow’s need hierarchy theory and Herzberg's two factor theory for motivation?[16]

(or)
(b) Discuss the need, construction and applications of control charts for variables. [16]
14. (a). Discuss the objectives, process, outcome and benefits of FMEA?[16]

(or)
(b). Explain about the following :(i). QFD process[8] (ii). Benchmarking process[8]
15.(a). (i). Explain about quality system auditing?[8]
(ii) Discuss the implementation of ISO:9000:2000 quality systems?[8]

(or)
(b).(i). Explain about the documentation process in ISO 9000:2000 systems? [8]
(ii) Discuss ISO 14000 requirements and its benefits?[ 8]
University Question Bank
Model 2
Answer ALL questions
PART A —— (10 x 2 = 20 marks)

1. What are the activities of quality planning?

2. What is the philosophy behind „Management by Wandering Around“ (MBWA)?

3. What are the important factors that influence purchase?

4. Is cleanliness the only benefit of implementing „5S“ practices?

5. What is the purpose of Pareto Diagrams?

6. How are the measures of central tendency used in quality analysis?

7. What are the reasons for benchmarking?

8. What are the losses reduced by TPM?

9. What is the purpose of ISO 9000 quality system?

10. How does the conceptual approach to ISO 14001 differ from ISO 9001?

PART B —— (5 X16 = 80 marks)

11. (a) (i) What are the dimensions of quality? Discuss eight of them. (8) (ii) What are the duties of quality council? (8) (Or)

(b) (i). What are the steps in strategic planning? I (8) (ii) What are the barriers to TQM., implementation? How are they eliminated? (8)

12. (a) (i) What is the concern of most consumer? Is it price of the product or service? Explain in detail. (4) (ii) What are the different ways of receiving customer feedback? How are the feedback used? (or)

b) (i) What are the types of teams formed in industries? Discuss the functions of any four of them (8) (ii) How is PDSA cycle used? Discuss with a case study. (8)

13. (a) (i) Draw cause and effect diagram for an engineering problem. (8) . (ii) What are the interpretations of different shapes of histograms? (8) . (or)

(b) (i) An industrial product was subjected to inspection with a batch size of 5-00 for ten consecutive days- The number of defective pieces found are 33, 42, 44, 56, 60, 43, 55, 42, 28.and 70. Draw a p-chart and discuss. (12) (ii) How is Process Decision Program Chart (PDPC) used? Give an example. (4)

14. (a) Draw the house of quality for an industrial product. Explain various 4 stages. . (16)
(or) How is FMEA performed? Discuss with an example; Draw the table and give details. (16)

(or) What are the steps in the implementation of ISO 9000 quality system. Discuss in detail.

(b) (i) Discuss the environmental management system model with a block diagram.(10) (ii) What are the global benefits of environmental management system? Discuss-in detail.(6)

ALL THE BEST