

383001S

Section A : Basic Concepts (30 Marks)

- This section consists of questions with serial number 1 - 30.
- Answer all questions.
- Each question carries one mark.
- Maximum time for answering Section A is 30 Minutes.

1. Which of the following dimensions of quality focuses on the primary characteristics of a product, such as the brightness of the picture for a television and clarity of sound for a music system?
- (a) Performance ✓
 (b) Conformance ✓
 (c) Aesthetics
 (d) Reputation
 (e) Reliability.
2. Quality cost analysis allows the quality improvement program to concentrate on the vital few quality problem areas. Which of the following costs are optimized when there are no identifiable and profitable projects for reducing them?
- I. Appraisal costs.
 II. Failure costs.
 III. Prevention costs.
- (a) Only (I) above
 (b) Only (III) above
 (c) Both (I) and (II) above
 (d) Both (I) and (III) above
 (e) All (I), (II) and (III) above.
3. Which of the following ISO standards discusses the fundamental concepts related to the Quality Management System (QMS)?
- (a) TL 9000
 (b) ISO 9000:2000
 (c) ISO/TS 16949 ✓
 (d) ISO 9001:2000
 (e) ISO 9004:2000 ✓

4. Quality Function Deployment (QFD) concentrates on customer expectations and needs to determine what exactly a customer desires from a product. Which of the following information often relates to the true voice of the customer?
- (a) Solicited, measurable and routine data
 - (b) Unsolicited, measurable and routine data
 - (c) Solicited, subjective and routine data
 - (d) Solicited, subjective and haphazard data
 - (e) Unsolicited, subjective and haphazard data.
5. Think win-win is one of the habits of highly effective people. Win-win embraces various interdependent dimensions of life. Which of the following dimensions of life emphasizes trust between two parties and committing strongly to win-win situation?
- (a) Character
 - (b) Relationship
 - (c) Agreements
 - (d) Systems
 - (e) Processes.
6. A manufacturing company stated that the machine's available time is 78.8%, Performance efficiency is 94.2% and Rate of quality for products produced is 99.7%. What is the machine effectiveness for the organization?
- (a) 43%
 - (b) 54%
 - (c) 62%
 - (d) 74%
 - (e) 83%.
7. Sometimes the process costs might be more for the owners due to the system performing unacceptably. However, the end user might be satisfied by the product. Under such a situation, which of the following problems is encountered in the process when the system is not performing up to the standards?
- (a) Compliance
 - (b) Efficiency
 - (c) Process design
 - (d) Product design
 - (e) Unstructured.
8. Management tools are useful in process improvement, cost reduction, policy deployment and new product development. Which of the following statement(s) is/are not true for affinity diagram?
- i. It generates less number of issues/ideas.
 - ii. It breaks down group barriers and facilitates breakthroughs.
 - iii. It states the issues in a full sentence.
- (a) Only (i) above
 - (b) Only (ii) above
 - (c) Only (iii) above
 - (d) Both (i) and (ii) above
 - (e) Both (i) and (iii) above.

9. Manufacturing organizations should measure and track the loss due to break down or any other disorder in the machines. Which of the following represents loss due to poor quality?
- (a) Changeovers
 - (b) scrap
 - (c) Start-ups
 - (d) Minor stoppages
 - (e) Lack of material.
10. Unethical behavior is associated with various types of costs. Which of the following costs can be addressed by involving employees or leaders in the development of goals and values and in developing policies allowing individual diversity, dissent, and decision making input?
- (a) Costs from pressure
 - (b) Costs from opportunity
 - (c) Costs from attitudes
 - (d) Costs from simplicity
 - (e) Costs from risk.
11. An organization requires to measure and track loss areas in order to identify the improvement needs of different departments. Which of the following can be treated as unplanned downtime losses?
- (a) Start-ups
 - (b) Minor stoppages
 - (c) changeovers
 - (d) Process nonconformities
 - (e) Slow-downs.
12. If a process specification limit is set $\pm 3\sigma$, then the process capability index (C_p) is
- (a) 0.1
 - (b) 1.0
 - (c) 1.33
 - (d) 0.33
 - (e) 0.67.
13. Total productive maintenance (TPM) comprises different steps to maintain highest production level of an organization. Which of the following statements is/are correct for autonomous work group?
- I. It has the authority to take decisions about keeping the equipment in first class running order.
 - II. It utilizes highly skilled maintenance technicians in routine maintenance activity.
 - III. It follows the same structure in different applications and industries.
- (a) Only (I) above
 - (b) Only (II) above
 - (c) Only (III) above
 - (d) Both (I) and (II) above
 - (e) Both (I) and (III) above.

14. Quality Function Deployment (QFD) is a team-based management tool in which customer expectations are used to drive the product development process. Which of the following is not a benefit of QFD?
- (a) Improves customer satisfaction
 - (b) Reduces implementation time
 - (c) Forces vertical deployment of communication channels
 - (d) Promotes teamwork
 - (e) Provides documentation.
15. In order to become successful, a leader requires an intuitive understanding of the basic needs, wants and abilities of people. To be effective, a leader needs to understand that
- I. People, paradoxically, need security and independence at the same time.
 - II. People can process a lot of facts at a time. ✗
 - III. People trust statistical data more than their gut reaction. ✗
 - IV. People like to hear a kind word of praise.
- (a) Both (I) and (II) above
 - (b) Both (I) and (III) above
 - (c) Both (I) and (IV) above
 - (d) Both (II) and (III) above
 - (e) Both (III) and (IV) above.
16. Which of the following statements is/are true regarding the procedure followed in developing a Process Decision Program Chart (PDPC)?
- I. The first level activities include registration, presentations and facilities.
 - II. Countermeasures are brainstormed and placed in the what-if level.
 - III. It provides the mechanism to effectively minimize uncertainty in an implementation plan.
- (a) Only (I) above
 - (b) Only (II) above
 - (c) Only (III) above
 - (d) Both (I) and (II) above
 - (e) Both (I) and (III) above.
17. An organization should carefully analyze the internal and external environment before choosing the right improvement strategy. Which of the following statements is/are appropriate for reinvention improvement strategy?
- I. It is preceded by the feeling that the current approach will never satisfy customer requirements. ✓
 - II. It does not make the process better than the original design. ✗
 - III. It helps an organization to maintain competitive advantage. ✓
- (a) Only (I) above
 - (b) Only (II) above
 - (c) Only (III) above
 - (d) Both (I) and (II) above
 - (e) Both (I) and (III) above.

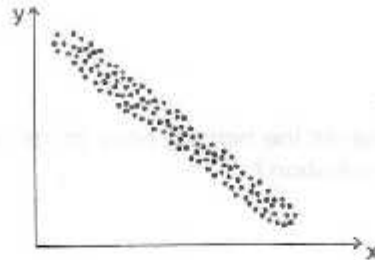
18. In a matrix diagram, which of the following format is used to establish relationship between three variables?
- (a) L - shape
 (b) Z - shape
 (c) T - shape
 (d) C - shape
 (e) X - shape.
19. While designing a wheel for a car, if one of the attribute of the wheel has a product rating of 5 and the target value is 7, then the scale up factor is
- (a) 0.7
 (b) 0.9
 (c) 35
 (d) 1.4
 (e) 2.4.
20. Customers constantly evaluate products and services of an organization against those of its competitors to determine who provides the greatest value. Which of the following dimensions of quality describes the customer's perceptions of value in relation to each product and service?
- (a) Performance
 (b) Service
 (c) Warranty
 (d) Features
 (e) Price.
21. The following table provides the measurements of thickness of aluminum plate used in a product.

Sample	Thickness (mm)				
1	10	13	27	21	15
2	23	29	12	16	26
3	17	14	19	26	24
4	12	19	13	16	18
5	15	19	24	23	29

Calculate the average of Range (R) from the data given above.

- (a) 9.90
 (b) 10.50
 (c) 12.45
 (d) 13.40
 (e) 14.38.

22. A team working on an air-conditioning problem may be interested in finding out the relation between the condenser temperature and room temperature. Condenser temperature is plotted on the x-axis and is the independent variable. Room temperature is on the y-axis and is the dependent variable. The data collected are plotted in the following scatter diagram.



If the relationship between condenser temperature and room temperature is that of cause-and-effect, then which pattern does the above scatter diagram represent?

- (a) No correlation
 - (b) Positive correlation
 - (c) Negative correlation
 - (d) Correlation by stratification
 - (e) Curvilinear relationship.
23. In which of the following team development stages, emotional conflict is reduced by cooperation, cohesion, and team members start behaving normally with constructive criticism?
- (a) Norming
 - (b) Forming
 - (c) Storming
 - (d) Performing
 - (e) Adjourning.
24. The variation in the process due to faulty inspection equipment, the incorrect application of a quality standard or too heavy a pressure on a micrometer is referred to as
- (a) Equipment variation
 - (b) Reported variation
 - (c) Material variation
 - (d) Operator variation
 - (e) Environment variation.
25. Listening to the voice of customers can be accomplished by numerous information-collecting tools. Which of the following is **not true** regarding comment card?
- (a) It is a low-cost method of obtaining feedback from customers
 - (b) It helps an organization to know what influences the customer to buy the product
 - (c) It collects general information from the customers
 - (d) It is a good medium to provide true measure of customers' feelings
 - (e) It is provided by restaurants and hotels at the end of tables and in hotel rooms.

26. Which of the following costs incur to the organization because less than full product or service performance is achieved as required by contracts with customers or by government rules and regulations?
- (a) Lost sales
 - (b) User goodwill
 - (c) Penalty
 - (d) Warranty claims
 - (e) Liability.
27. Which of the following represents the highest point of the histogram, when the data are grouped into a frequency distribution?
- (a) Dispersion
 - (b) Median
 - (c) Central tendency
 - (d) Mode
 - (e) Standard deviation.
28. Rajasthan Industrial Products Corporation has a policy of promoting their employees based on their skills and abilities. This policy provides opportunity to the individuals to move up the corporate ladder as far as their abilities allow them to go. Some employees do not want to go for higher positions. However, the management policy communicates the potential opportunities provided by the company to those employees who really willing to reach higher positions. Which of the following needs does this refer?
- (a) Survival >
 - (b) Security >
 - (c) Social >
 - (d) Esteem
 - (e) Self-actualization.
29. House of Quality is a primary planning tool that translates the voice of customers into design requirements. Which of the following parts of House of Quality represents the interrelationship between technical descriptors?
- (a) Exterior walls of the house
 - (b) Second floor of the house
 - (c) Roof of the house
 - (d) Interior walls of the house
 - (e) Foundation of the house.
30. Organizations are emphasizing on service quality to win and retain customer satisfaction. Which of the following elements of service quality focuses on optimizing the trade-off between time and personal attention?
- (a) Organization
 - (b) Customer care
 - (c) Communication
 - (d) Front-line people
 - (e) Leadership.

END OF SECTION A

Section B, Problem Caster (80 Marks)

This part contains questions of qualitative and quantitative nature. It is divided into two parts, B and C. Part B contains 10 questions and part C contains 10 questions. The total marks for this part are 80. The questions are to be attempted in the order in which they are given. The questions in part C are to be attempted only after the questions in part B have been attempted.

Table with 3 columns and 10 rows. The columns are labeled 'Q. No.', 'Marks', and 'Solved'. The rows contain numerical data for each question.

Sections B&C

Section B : Problem/Caselets (50 Marks)

- This section consists of questions with serial number 1 – 5.
- Answer all questions.
- Marks are indicated against each question.
- Detailed workings/explanations should form part of your answer.
- Do not spend more than 110 - 120 minutes on Section B.

1. Data are obtained on the width of a product. Five observations per period are sampled for 10 periods. The data are shown in the following table.

Period	Observations				
	X1	X2	X3	X4	X5
1	20.5	19.8	19.5	19.3	19.9
2	20.0	19.8	20.2	19.7	20.1
3	19.8	19.8	20.6	20.9	20.2
4	19.8	19.9	19.7	19.6	20.7
5	19.9	20.1	19.9	19.9	20.3
6	19.8	19.7	20.2	19.9	19.7
7	19.6	19.2	19.5	20.2	20.8
8	20.4	19.6	20.1	19.1	19.7
9	20.9	19.4	20.2	20.0	20.6
10	19.1	19.5	20.0	20.1	20.3

Determine the control limit and trial control limits for \bar{X} and R charts and the process capability.

(The value of A_2 , d_2 , D_3 and D_4 are 0.577, 2.326, 0 and 2.114 respectively.)

(10 marks)

Caselet 1

Answer the following questions based on the given Caselet:

2. It cannot be denied that human capital was a priceless asset and the workers have to be properly trained for effective implementation of Total Productive Maintenance (TPM) program. Discuss the training programs conducted by IESB. (10 marks)
3. In addition to the training program, discuss the various initiatives taken by the firm for effective implementation of TPM. (10 marks)

IESB is a manufacturing company, located in Nilai Industrial Area, Malaysia. It produces automotive components such as beltline moulding part, weather strip, pillar drip moulding etc. The company uses latest technology of roll-forming, coextrusion, flocking and stretch-bending processes. Generally, all the components were supplied to PROTON and PERODUA and other car manufacturers as well such as Honda, Mitsubishi and Ford. Like many organizations, which continue searching for excellence programs to improve their competitiveness, the top management introduced TPM primarily focusing on autonomous maintenance program.

The first step was established to ensure operators develop an interest and concern of their equipment through frequent contact. An initial cleaning and inspection was

started by the management. The work place cleaning reveals numerous abnormalities. These abnormalities, if not detected in time can lead to major breakdowns or other losses. Hence, the management emphasizes on early detection of problems through the cleaning process. Therefore, cleaning is implemented as the first step in the regular production activity for continuous improvement of equipment performance. The operators are encouraged to carry out the general cleaning and inspection of each equipment and machine in the beginning of each working day. A check sheet called the Daily Preventive Maintenance Check Sheet for each machine was prepared as part of the procedure. The daily checks carried out by the operators were part of the maintenance program.

Sometimes, workers find it difficulty in cleaning and inspection and it is observed that the activity is taking more time than required. The production supervisors worked to reduce the delay and to make the process ease. Cleaning and inspection can be made a lot easier if the sources of contamination can be determined and controlled. At the assembly line, machines were placed in such a way that all parts of the machines were accessible. They were installed by maintaining sufficient distance to each other as well as to the floor. This way, dusts and dirt can be cleaned easily and without having to remove equipment or parts. Similarly, the operators easily did oil levels, air pressures, and other parameters checking due to no hidden areas. For example, when the oil level in the hydraulic tank was below minimum, operators will just have to top it up very easily since the locations of level indicators were just behind of each machine. Every team in all lines was responsible for their work place. The teams cleaned and improved their work place accordingly. Quality personnel will go around assessing the cleanliness of each line and team with the highest mark will be announced as the winner. Rewards in terms of monetary and certification will be given. Basically, operators were not permitted to do technical maintenance works especially dismantling machines in order to do overhauling. However, the maintenance technician was assigned this job once a month. As part of a scheduled maintenance program, a Monthly Preventive Maintenance Check Sheet was prepared.

To date, IESB have not yet developed any cleaning or lubrication standards. For an effective implementation of TPM program, the organization felt the need to maintain these standards. In this step, teams decide which parts of the equipment needs cleaning and how often, which methods to use, what to inspect while cleaning, how to judge whether conditions were normal etc. These standards, which were developed through experience, were intended to help the operators do their cleaning tasks with more confidence and ability. The lubrication standards were not developed by the internal teams but merely following the standards supplied by the machine manufacturers. Operators only have to follow what was stated in these standards and make changes wherever possible that substitutes the type of oil allowed. Periodically, operators carry out basic inspection and lubrication according to the daily checklist. The technicians started steps to improve the lubrication system. Necessary steps have been taken to measure the lubricant consumption rate, review the disposal method for used lubricant, establish a service station, or other improvements concerning lubrication system. Regarding service stations, a special separated area called the Maintenance Area was prepared not far from assembly line to carry out certain types of maintenance activities. Blades inside the Metal Saw Cutting machine were sharpen at this particular area by the

maintenance department technicians after a certain number of parts being produced, based on the reading displayed on the Metal Saw Cutting machine counter.

It cannot be denied that human capital was a priceless asset and the workers have to be properly trained. In the next stage, operators were trained and provided with ample knowledge by the supervisors or team leaders in order to get better understanding of the equipments at their work place. This step was attempted to monitor deterioration through general inspection of equipment. Basically, new workers at IESB will be exposed a comprehensive induction training. Fundamental knowledge about safety procedures, daily operations standards, work place management, etc. was some of the contents in the training session. On the hand, on the job training also being carried out especially to understand the processes involved in the production of a beltline moulding. The operators will also be introduced to the machines and equipment required in order to produce a specific part. Moreover, the following were some of the training provided to operators: At the end of each session of On Job Training, a team leader will assess the operator's skills and knowledge according to the lists in the training material prepared and the operators were allocated to various production lines throughout the factory. Basically, the training provided showed an improvement in the production floor, particularly in assembly line. On the other hand, breakdowns of die, bar materials, electrical and mechanical failures were the most frequent in this company. The failure causes however, showed that human related failures also need to be given special attention. It was discovered that through intensive training and education programs, the number of breakdowns frequency shows improvements in term of reduction in breakdowns. Moreover, Production Engineering that responsible in Autonomous Maintenance program planned a structured training program especially in ensuring basic equipment conditions. This activity involved cleaning, lubrication and bolting. Moreover, the management also outlined 7 cleaning check points in order to detect any abnormalities and hidden defects. However, in the assembly line, attention only given to 3 aspects of cleaning check points. In addition, training for housekeeping particularly related to maintain equipment cleanliness was periodically conducted and external consultant was assigned to deliver the training program and assessment.

END OF CASELET 1

Caselet 2

Answer the following questions based on the given Caselet:

4. The challenge to GCC RIO GRANDE was to provide value and quality to the customers beyond that of the cement product. In this context, analyze various approaches adopted by GCC RIO GRANDE to achieve customer satisfaction. (10 marks)
5. Today, many forces of change are influencing the cement industry. With reference to the caselet, what are the critical challenges and barriers in the sustainable development of cement industry? (10 marks)

GCC RIO GRANDE owns a cement manufacturing facility in New Mexico. The plant is located near Albuquerque in Tijeras, NM, and services central and northern New Mexico. The customer base of the company fall into three major categories, ready mix customers, pre-cast concrete and concrete block customers, and home improvement centers.

GCC RIO GRANDE enjoys nearly an 85% market share in central New Mexico. However, cement manufacturers in Texas, New Mexico and Arizona have expanded their production capacities. Potential competitors have conducted market studies for New Mexico, and plan to ship cement into the region.

Progressive cement companies are recognizing that to remain competitive and for sustainable development in future, they must combine sound financial performance with a commitment to social responsibility, environmental stewardship and economic prosperity. Because cement properties are dictated by specification, differentiation between products is usually not much of a driver of the purchasing decision. Cement companies often enter a market by lowering the price, and price wars sometimes develop.

The challenge to GCC RIO GRANDE was to provide value beyond that of the cement product, through relationships and value-added services. The concrete market, through acquisitions, mergers, and changing personnel, has needs that constantly change. The needs of large concrete producers are different than those of smaller companies. To continue their success, GCC RIO GRANDE had to recognize these changing needs and respond. GCC RIO GRANDE needed a method to validate, refine, and adapt to a changing marketplace.

To satisfy customers, GCC RIO GRANDE planned to understand how meeting their requirements effected satisfaction. The company realized that mass customization can be a way to provide variety at an affordable cost. The hard data was collected to know what the customers want to buy. This information was also used to provide more standardized products.

Sales people heard by just asking customers what they want. These requirements satisfied, or dissatisfied in proportion to their presence or absence in the delivered service. The faster the service, the more they like or dislike it. Sometimes, customers failed to mention their basic expectations of the service, without which the service ceased to be of value; their absence was very dissatisfying. Expected requirements, though unspoken, must be fulfilled. There were some other requirements that were difficult to discover. They were beyond the customer's expectations. Customers were not even be aware such service even exists, and so these requirements go unspoken. Thus, it was the responsibility of the organization to explore customer problems and opportunities to discover these new levels of service.

The core GCC RIO GRANDE team identified project goals and key customer segments. Goals such as profit, sales volume, and market controllers were clarified, prioritized, and quantified. Next, the team visited key customers to document their cement use and concrete production processes. They examined their materials handling process and logistics processes, and then studied the paperwork process in the office. Here they learned that the company's pricing and quotation strategies were often perceived as guessing and inconsistent with the future needs of the customers – the general contractors. A customer process table was constructed with additional data to match the customer's problems and opportunities. Customers' problems and opportunities statements were sorted on the basis of whether each represented a customer demanded quality or a product/service feature such as quality attribute, service function, fail point, etc.

The next step was to get customer to prioritize their needs, the Demanded Quality, and to ask them to compare the company's services with those of competitors. A questionnaire was created for the sales force to take to customers. The responses were entered into the Quality Planning Table to calculate Demanded Quality Weights and Service Function Weights. The process followed revealed that by timing price increases with certain customer practices, relationships could be improved.

GCC RIO GRANDE often issued letters of notice in March for a September price increase. The company believed that, because of the early notice, customers had time to plan their cost and pricing structures. Additionally, customers often bid work in January for one year. Customers were unable to raise their prices to recover the additional cement cost.

GCC RIO GRANDE had a technical services department to assist customers with field problems. Concrete was delivered as a raw material, and was sometimes mishandled at construction sites. The company often acted as a third party consultant to resolve these issues. However, the process was often viewed as a means to defend the company against accusations that concrete problems were traceable to the cement. GCC RIO GRANDE realized that technical services are important to customers as a value-added service and efforts should be expanded, streamlined, and updated.

Other cement companies solicited business on the border areas of New Mexico. However, GCC RIO GRANDE fared very well. A customer told one of their competitors that he would not change, because GCC RIO GRANDE assists him with concrete promotion. Although some other manufacturers have slightly better price than the company, the customers would not switch because GCC RIO GRANDE regularly helped them with problems concerning finished concrete. In 2001, the company lost business because of a lower price from a cement manufacturer in Texas but the customers allowed it to renegotiate their business, largely because GCC RIO GRANDE identified their need for assistance with a state trade association.

The cement industry is generating about 3% of global greenhouse gas emissions due to the dependence on fossil energy and the calcinations of limestone. The company is also looking to reduce the resources used in production and to protect the climate by changing existing standards and specifications. The firm is also giving high priority to employees well-being which is not consistent with best industry practices.

GCC RIO GRANDE may have new cement products available to possibly introduce in the future. The concrete industry, formerly dominated by small entrepreneurial enterprises, is changing to one with large, high tech owners. The company's next step is to identify potential partnerships with technology. The sales staffs of the company have plans to possibly train customers to cope with problems coping with business issues, such as accounts receivable, environmental problems, and potential e-business opportunities.

END OF CASELET 2

END OF SECTION B

Section C : Applied Theory (20 Marks)

- This section consists of questions with serial number 6 - 7.
- Answer all questions.
- Marks are indicated against each question.
- Do not spend more than 25 - 30 minutes on Section C.

6. In today's dynamic business environment, organizations are striving hard to survive. Discuss Deming's philosophy that provides a theory for management to improve quality, productivity and competitive priority of a firm. (10 marks)
7. Problems are inevitable in groups. Most problems required a structured approach to resolve them. In this regard, discuss the common problems arise in teams and their solutions. (10 marks)

END OF SECTION C

END OF QUESTION PAPER