Roll No……

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POST GRADUATE DIPLOMA IN MANAGEMENT (2024-26)

MID TERM EXAMINATION (TERM -III)

Subject Name: **Total Quality Management (TQM)** Time: **01.00 hrs**

Sub. Code: **PGO32** Max Marks: **20**

Note: All questions are compulsory.

Section -A

Read the following use-case and answer the following questions: **10×2 = 20 Marks**

Case Study: Total Quality Management in the Automobile Parts Industry

Swift Auto Components Ltd. is a leading manufacturer of precision-engineered automobile components, specializing in engine mounting bolts, brake pads, and suspension springs. Established 25 years ago, the company has maintained a reputation for delivering high-quality products to automobile manufacturers. However, as the industry grows increasingly competitive, Swift Auto Components Ltd. has recognized the need to implement Total Quality Management (TQM) to enhance production efficiency, minimize defects, and optimize quality-related costs.

One of the key challenges faced by the company is ensuring that the engine mounting bolts, which have a specified diameter of 10mm ± 0.1mm, meet stringent quality standards. Any deviation beyond the acceptable tolerance range could result in performance failures and customer dissatisfaction. To monitor production consistency, the company conducts hourly sampling, measuring the diameter of five randomly selected bolts from the production line. The recorded measurements are then analyzed using Statistical Process Control (SPC), specifically the $\bar{X}$ chart (mean control chart) to determine whether the manufacturing process is in control.

The production team has collected the following diameter data for five different hourly samples:

Sample No.	Bolt 1	Bolt 2	Bolt 3	Bolt 4	Bolt 5
1	10.1	10.2	9.9	10.0	10.1
2	9.8	10.0	9.7	9.9	10.0
3	10.2	10.3	10.1	10.0	10.1
4	9.9	9.8	10.0	10.1	9.9
5	10.0	10.2	9.8	10.0	9.9

By computing the sample mean ($\bar{X}$) for each sample, the company can construct a control chart and determine whether the process exhibits significant deviations.

In addition to statistical quality control, Swift Auto Components Ltd. also faces high costs associated with quality assurance. A cost analysis was conducted across three key product lines—brake pads (Product X), fuel injectors (Product Y), and suspension springs (Product Z)—to assess cost-saving opportunities. The company categorized its quality costs into prevention, appraisal, internal failure, and external failure costs to evaluate the total financial impact of quality management.

The following Quality Cost Statement was generated for the three product lines:

Quality Cost	Product X (₹)	Product Y (₹)	Product Z (₹)
Prevention Costs	8,200	2,800	4,500
Appraisal Costs	25,300	12,100	5,700
Internal Failure Costs	12,700	95,500	44,600
External Failure Costs	45,900	120,600	15,300
Total Sales Revenue	10,500,000	7,800,000	5,400,000

This breakdown highlights the areas where the company incurs the highest quality-related costs, particularly in internal and external failure categories, which indicate substantial financial losses due to defective products. Management is keen to explore strategies to reduce quality failures, improve prevention mechanisms, and optimize cost efficiency to sustain profitability in the competitive automobile industry.

Case Discussion Questions

Question 1: Statistical Quality Control (10 Marks) CO1
Swift Auto Components Ltd. monitors its bolt manufacturing process by taking hourly samples of 5 bolts and recording their diameters. The quality control team aims to construct an $\bar{X}$ chart to assess process stability.
Tasks:

1. Calculate the sample mean ($\bar{X}$) for each sample based on the provided data.
2. Determine if the production process is in control by analyzing the $\bar{X}$ chart trends.

Consider- A_2- 0.577
d_2- 2.326 (if required)

Question 2: Quality Cost Analysis (10 Marks) CO2
Swift Auto Components Ltd. is evaluating its Quality Cost Structure to identify areas for cost savings and efficiency improvements.
Tasks:

1. Calculate the total quality cost for each product line and determine the percentage of total quality cost relative to sales for each product.
2. Identify cost-saving opportunities and recommend strategies to reduce quality-related expenses.