**JAIPURIA INSTITUTE OF MANAGEMENT, NOIDA**

**PGDM / PGDM (M) / PGDM (SM)**

**SIXTH TRIMESTER (Batch 2020-22)**

**ENDTERM EXAMINATION, April 2022**

| | | | |
|---|---|---|---|
| Course Name | Total Quality Management (TQM) | Course Code | OM-601 |
| Max. Time | 2 hours | Max. Marks | 40 MM |

INSTRUCTIONS:

a. Overall Permissible Plag. is 15%, **Penalty Clause: 15-25% - Minus 5 Marks, Above 25% - Reappear**.
b. Attempt both Parts I & II and its Questions.
c. Students shall write their answers in word file along with *Charts and Tables with brief explanation,* wherever required. Upload the answer sheet in *word or pdf format*.

## Part I

**Case: Knight Industries**

Knight Industries is a medium-sized paint manufacturer. The process of making paint consists of four major steps: weigh-up, premix, milling, and letdown. In the weigh-up stage, the ingredients are added to a tank one at a time according to the formula. Next, the batch is mixed on a dispersion mixer; this premix stage takes about 30–60 minutes. Then the batch is pumped into an agitated vessel that contains a milling medium (small steel or titanium dioxide balls of consistent size), which reduces it to a specified particle size. Finally, the paint is removed from the mill and allowed to cool, then tested. Solvent is lost during the milling stage because of elevated temperatures; in the letdown stage, solvent is added to lower the viscosity to proper levels.

Viscosity, percent weight solids, and weight per gallon are all important quality characteristics because they determine the dry thickness, how well it applies to a surface, and corrosion properties. For a particular type of paint used by automotive companies to prevent corrosion, specifications are

Viscosity: 60–80 Pa.-Sec.

Weight solids: 60–65 percent

Weight per gallon: 12.6–13.5 Lb./Gal.

The table appended below contains the data for a series of batches that were produced. Using appropriate SPC charts or other statistical tools, solve the following:

1) Identify the suitable *Statistical Process Control (SPC) charts* and Construct appropriate SPC chart on excel sheet for "Viscosity"? Interpret the observations made from these SPC charts in your reflection. (10 Marks)

2) Evaluate how well the process is in control and its capability to meet requirements with the help of process capability measure for all three quality characteristics i.e. *Viscosity, percent weight solids, and weight per gallon*? (10 Marks)

3) Based on your findings from SPC chart and Process capability measures compile your results and explain and make recommendations to the plant manager. (5 Marks)

| **Knight Industries** | | | |
|---|---|---|---|
| Data from Chemical Batches | | | |
| Batch | Viscosity | Percent Solids | Lb./Gal. |
| 1 | 74 | 64.2 | 13.3 |
| 2 | 69 | 62.6 | 13.4 |
| 3 | 79 | 63.7 | 13.4 |
| 4 | 75 | 63.6 | 13.3 |
| 5 | 62 | 62.4 | 13.2 |
| 6 | 69 | 63.4 | 13.2 |
| 7 | 73 | 63.2 | 13.3 |
| 8 | 79 | 63.0 | 13.3 |
| 9 | 68 | 63.8 | 13.5 |
| 10 | 69 | 63.5 | 13.4 |
| 11 | 77 | 63.0 | 13.3 |
| 12 | 79 | 63.1 | 13.3 |
| 13 | 74 | 62.9 | 13.2 |
| 14 | 79 | 63.4 | 13.3 |
| 15 | 73 | 62.6 | 13.2 |
| 16 | 76 | 63.3 | 13.3 |
| 17 | 79 | 64.1 | 13.3 |
| 18 | 70 | 62.7 | 13.2 |
| 19 | 69 | 63.8 | 13.2 |
| 20 | 74 | 63.9 | 13.3 |
| 21 | 75 | 63.4 | 13.3 |
| 22 | 74 | 62.7 | 13.3 |
| 23 | 70 | 62.9 | 13.3 |
| 24 | 75 | 62.9 | 13.2 |
| 25 | 65 | 62.8 | 13.2 |
| 26 | 69 | 62.9 | 13.2 |
| 27 | 74 | 62.6 | 13.2 |
| 28 | 72 | 63.4 | 13.2 |
| 29 | 77 | 63.2 | 13.3 |
| 30 | 73 | 63.0 | 13.3 |
| 31 | 77 | 62.6 | 13.2 |
| 32 | 79 | 62.6 | 13.2 |
| 33 | 79 | 62.5 | 13.2 |
| 34 | 79 | 62.5 | 13.3 |
| 35 | 66 | 62.3 | 13.1 |
| 36 | 77 | 63.2 | 13.3 |

| | | | |
|---|---|---|---|
| 37 | 79 | 62.7 | 13.2 |
| 38 | 79 | 62.6 | 13.1 |
| 39 | 79 | 62.3 | 13.2 |
| 40 | 76 | 62.4 | 13.2 |
| 41 | 79 | 63.6 | 13.3 |

| | Control Chart Factors | | | | | | |
|---|---|---|---|---|---|---|---|
| n | A2 | D3 | D4 | d2 | A3 | B3 | B4 |
| 2 | 1.88 | 0 | 3.267 | 1.128 | 2.659 | 0 | 3.267 |
| 3 | 1.023 | 0 | 2.574 | 1.693 | 1.954 | 0 | 2.568 |
| 4 | 0.729 | 0 | 2.282 | 2.059 | 1.628 | 0 | 2.266 |
| 5 | 0.577 | 0 | 2.114 | 2.326 | 1.427 | 0 | 2.089 |
| 6 | 0.483 | 0 | 2.004 | 2.534 | 1.287 | 0.03 | 1.97 |
| 7 | 0.419 | 0.076 | 1.924 | 2.704 | 1.182 | 0.118 | 1.882 |
| 8 | 0.373 | 0.136 | 1.864 | 2.847 | 1.099 | 0.185 | 1.815 |
| 9 | 0.337 | 0.184 | 1.816 | 2.97 | 1.032 | 0.239 | 1.761 |
| 10 | 0.308 | 0.223 | 1.777 | 3.078 | 0.975 | 0.284 | 1.716 |

## Part II

4) Melissa Clare works for a software company as a technical support representative. Her duties include answering the telephone, providing information to customers, and troubleshooting technical problems. Her supervisor told her to be courteous and not to rush callers. However, the supervisor also told her that she must answer an average of 15 calls per hour so that the department's account manager can meet his or her budget. Melissa comes home each day frustrated because the computer is slow in delivering information, causing her to search for the information in complex manuals. When she is pressed for time, she often cuts the call off prematurely or provides only the minimal information necessary.
    a. Assuming yourself to be Supervisor Deming, examine the present situation? Explain which of the 14 Points might be violated. (6 Marks)
    b. Drawing upon Deming's principles, develop a plan to improve this situation. (4 Marks)
5) During one month, MegaInvCo (MIC) processed 51,000 invoices for Aplha Corp; 49,000 for Beta Corp; and 25,000 for Gamma Corp. Of these, 510 of the Alpha, 525 of the Beta, and 480 of the Gamma invoices had to be reprocessed for errors.
    a. Determine the overall defect rate and sigma level for all of the combined batches? (3 Marks)
    b. Also, compute and discuss for each individual batches? (2 Marks)