SLOT:B2+TB2

REG.NO.: 22BMM0008

# VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

## SCHOOL OF MECHANICAL ENGINEERING
## CONTINUOUS ASSESSMENT TEST (CAT) -II
## WINTER SEMESTER 2024-2025

| | | |
|---|---|---|
| Programme Name & Branch | : **B.Tech & Mechanical Engineering** | |
| Course Code | : **BMEE212L** | |
| Course Name | : **Quality Control and Improvement** | |
| Class Number(s) | : **VL2024250503794** | |
| Faculty Members | : **Dr.T.Sampath Kumar** | |
| Date of the Examination | : **17.03.25** | Slot: **B2+TB2** |
| Duration | : **90 minutes** | Max. Marks : **50** |

**General Instruction(s): Graph sheet should be provided**

- Answer all Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyze, 5 – Evaluate, 6 – Create)
- Course Outcomes Statements:

**CO2. Demonstrate the ability to design, use, and interpret control charts for variables and attributes**

**CO3. Determine the process capability indices for real time processes and demonstrate Six-Sigma**

**CO5. Implement the philosophy of Taguchi's DOE and other process improvement methods**

<table>
<tr><th>Q. No</th><th>Questions</th><th>M</th><th>CO</th><th>BL</th></tr>
<tr><td>1.</td><td>The number of nonconforming items in lots is shown below. Each lot consists of 400 items.<br><br>
<table>
<tr><td>Lot No.</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td></tr>
<tr><td>No. of non-conforming</td><td>24</td><td>38</td><td>52</td><td>26</td><td>36</td><td>30</td><td>42</td><td>52</td><td>20</td><td>16</td><td>20</td><td>24</td></tr>
</table>
i) Compute trial control limits for np-chart. State whether the process is in control or not? (5 Marks)<br>
ii) Calculate the revised control limits. (5 Marks)</td><td>10</td><td>02</td><td>BL4</td></tr>
<tr><td>2.</td><td>The following table gives the number of missing rivets (defects) noted at aircraft final inspection.<br><br>
<table>
<tr><td>Air Plane No.</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr>
<tr><td>No. of missing rivets</td><td>8</td><td>16</td><td>14</td><td>19</td><td>11</td><td>15</td><td>8</td><td>11</td><td>21</td><td>12</td><td>23</td><td>16</td><td>9</td></tr>
</table></td><td></td><td></td><td></td></tr>
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| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Air Plane No.** | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | | | |
| | **No. of missing rivets** | 25 | 15 | 9 | 9 | 14 | 11 | 9 | 10 | 22 | 7 | 28 | 9 | | | |

| | | | | |
|---|---|---|---|---|
| | i) Compute trial control limits for c -chart. State whether the process is in control or not? (5 Marks)<br>ii) Calculate the revised control limits. (5 Marks) | 10 | 02 | BL4 |
| 3. | The following are the $\bar{x}$ and R values of 4 subgroup of readings.<br>$\bar{x}$ = 15.2, 17.1, 15.8 and 15.9<br>R= 2.1, 2.3, 1.9 and 1.8<br>The specification limits for the components are 15.7±0.2<br>i) Find the process capability ratio (6 Marks)<br>ii) Determine if the product meets its specification. (2 Marks)<br>iii) Compute the one-sided lower process capability ratio (2 Marks)<br>Assume the following factor values for n=4:<br>$A_2 = 0.73$, $D_3 = 0$, $D_4 = 2.28$ and $d_2 = 2.059$ | 10 | 03 | BL4 |
| 4. | There are 3 divisions in a company that produces oil pumps. One division makes castings, second provides machined components. Assembly is done in the third division. These 3 divisions are supported by one, common warehouse.<br>All materials, components, supplies, and tools go through the warehouse. The problem faced by the company is with delivering right material to particular working cell on time and this made the management to do something about it. Leaders from all divisions decided to run an improving project to stabilize current situation.<br>**Defined project goal is:** To improve current 2-3 hours late deliveries to be on-time, to start production.<br>With the goal defined, demonstrate how the **DMAIC project** can be launched? Give details of implementation of each phase in brief. | 10 | 03 | BL4 |
| 5. | A machine is used to fill cans with motor oil additive. A single sample can is selected every hour and the weight of the can is obtained in Kg. Since the filling process is automated, it has very stable variability, and long experience indicates that $\sigma = 1$. The individual observations for 24 hours of operation are shown in below table1.<br>**Table 1.** | 10 | 05 | BL4 |

| **Sample No.** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **X** | 7.1 | 6.9 | 9.2 | 9.4 | 7.8 | 10.1 | 7.9 | 9.7 | 6.8 | 12.5 | 12.7 | 13.0 |

Assuming that the process target is 8.00. set up a tabular column for this process. Design the cusum using the standard values h = 5 and k = ½.

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