DPP-8 Maths- IV Unit - 5

Topic- Control charts

Q-1- The following data shows the value of sample mean $\bar{X}$ and arrange R for 10 samples of size 5 each. Calculate the values of central line and control limits for $\bar{X}$ chart and R-chart determine whether the process is under control.

Sample no.:	1	2	3	4	5	6	7	8	9	10
Mean $\bar{X}$:	11.2	11.8	10.8	11.6	11	9.6	10.4	9.6	10.6	10
Range R:	7	4	8	5	7	4	8	4	7	9

$$\bar{\bar{X}} = \frac{\Sigma \bar{X}}{n} = \frac{11.2+11.8+10.8+11.6+11+9.6+10.4+9.6+10.6+10}{10}$$

$$\boxed{\bar{\bar{X}} = 10.66}$$

$$\bar{R} = \frac{\Sigma R}{n} = \frac{7+4+8+5+7+4+8+4+7+9}{10} = \frac{63}{10}$$

$$\boxed{\bar{R} = 6.3}$$

Control limits for $\bar{X}$ chart -

$$\boxed{CL_{\bar{X}} = 10.66}$$

$$UCL_{\bar{X}} = \bar{\bar{X}} + A_2 \bar{R}$$
$$= 10.66 + 0.577 \times 6.3$$
$$\boxed{UCL_{\bar{X}} = 14.295}$$

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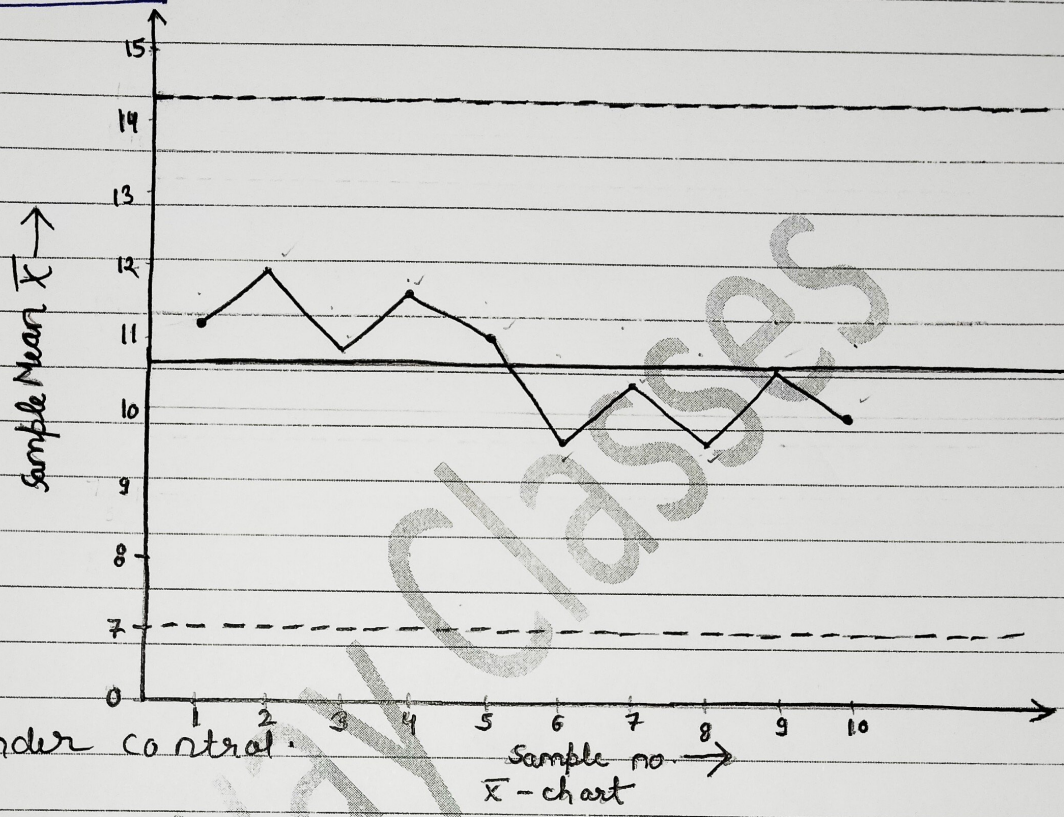
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$LCL_{\bar{X}} = \bar{\bar{X}} - A_2 \bar{R}$

$= 10.66 - 0.577 \times 6.3$

$LCL_{\bar{X}} = 7.0249$



Process is under control.

Control limits for R-chart

$CL = \bar{R}$

$CL = 6.3$

$UCL_R = D_4 \bar{R}$

$= 13.3245$

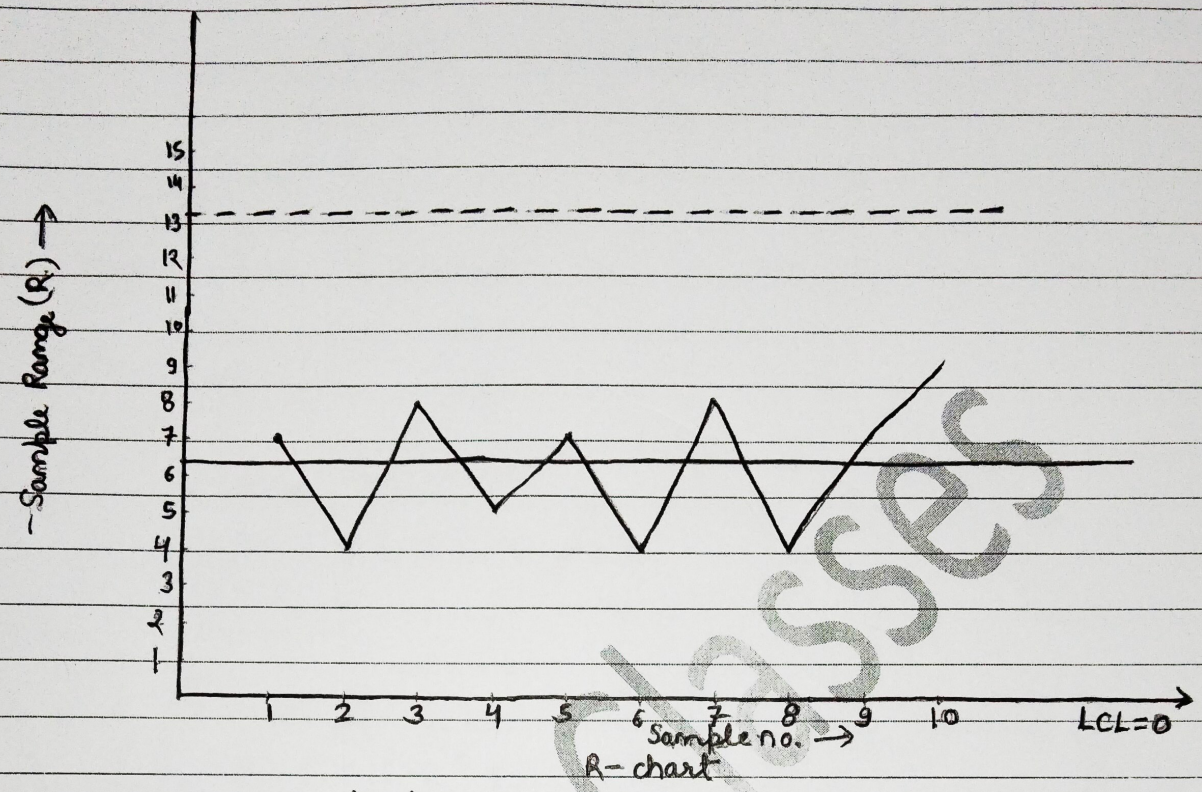
$LCL_R = D_3 \bar{R}$

$= 0$

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Q-2:- A company manufactures screws to a nomial diameter 0.500 ± 0.030 cm. Five samples were taken randomly from the manufactured lots and 3 measurment on each sample at diffrent lengths. Following are the readings:

Sample no	1	2	3	$\bar{X}$	R
1	0.488	0.489	0.505	0.494	0.017
2	0.494	0.495	0.499	0.496	0.005
3	0.498	0.515	0.487	0.500	0.028
4	0.492	0.509	0.514	0.505	0.022
5	0.490	0.508	0.499	0.499	0.018

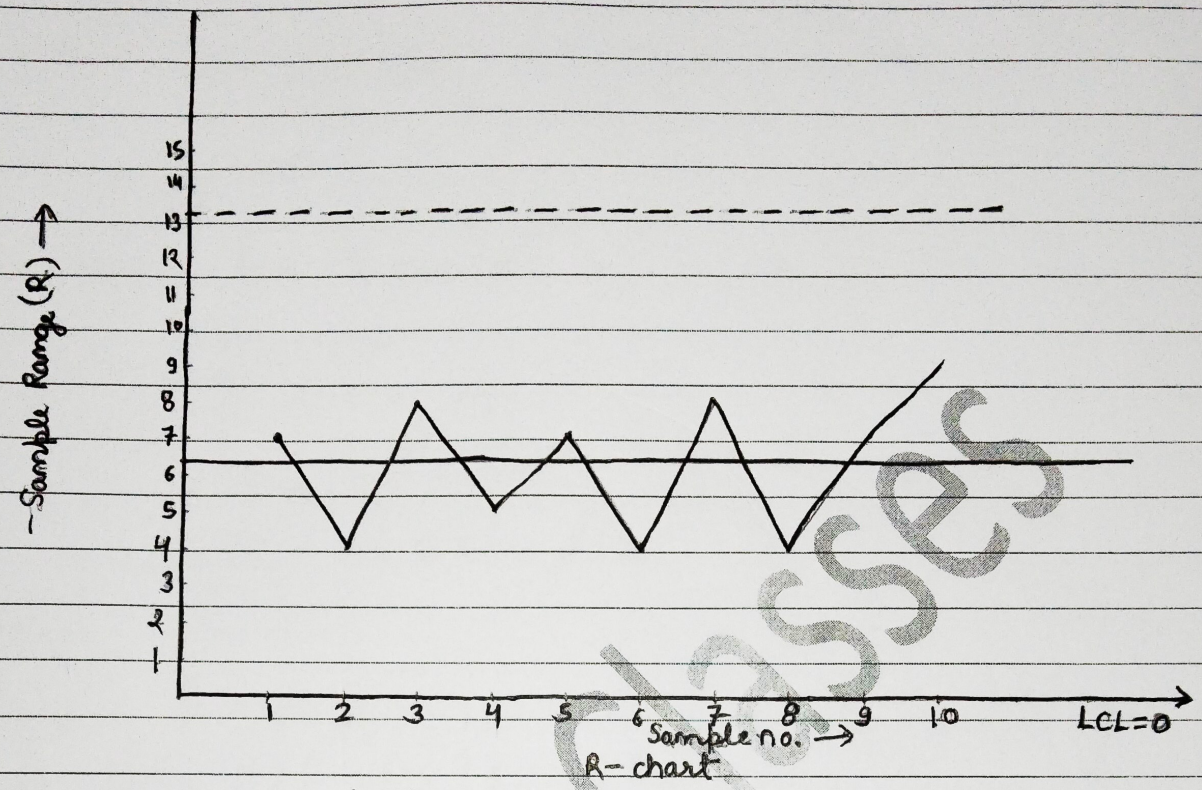
$A_2 = 1.02$, $D_4 = 2.57$, $D_3 = 0$

$$\bar{\bar{X}} = \frac{0.494 + 0.496 + 0.500 + 0.505 + 0.499}{5}$$

$$\bar{\bar{X}} = 0.4988$$

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R-chart

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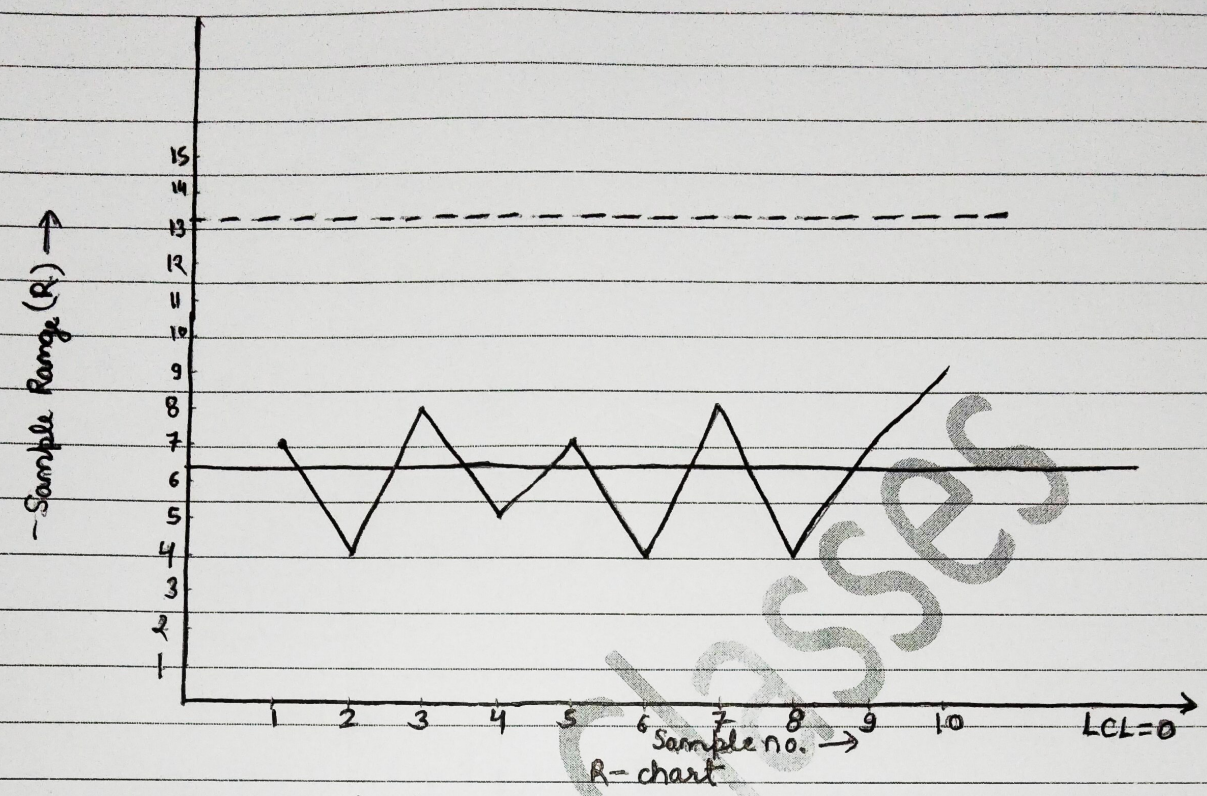
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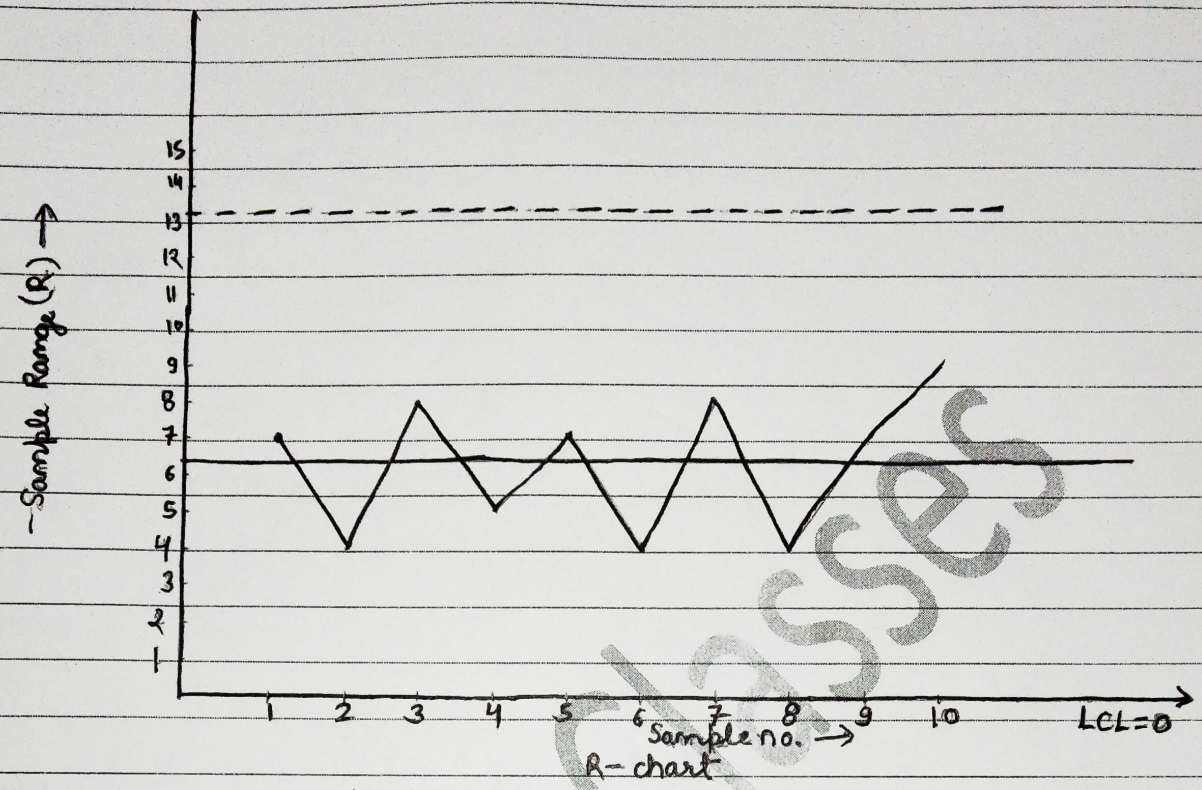
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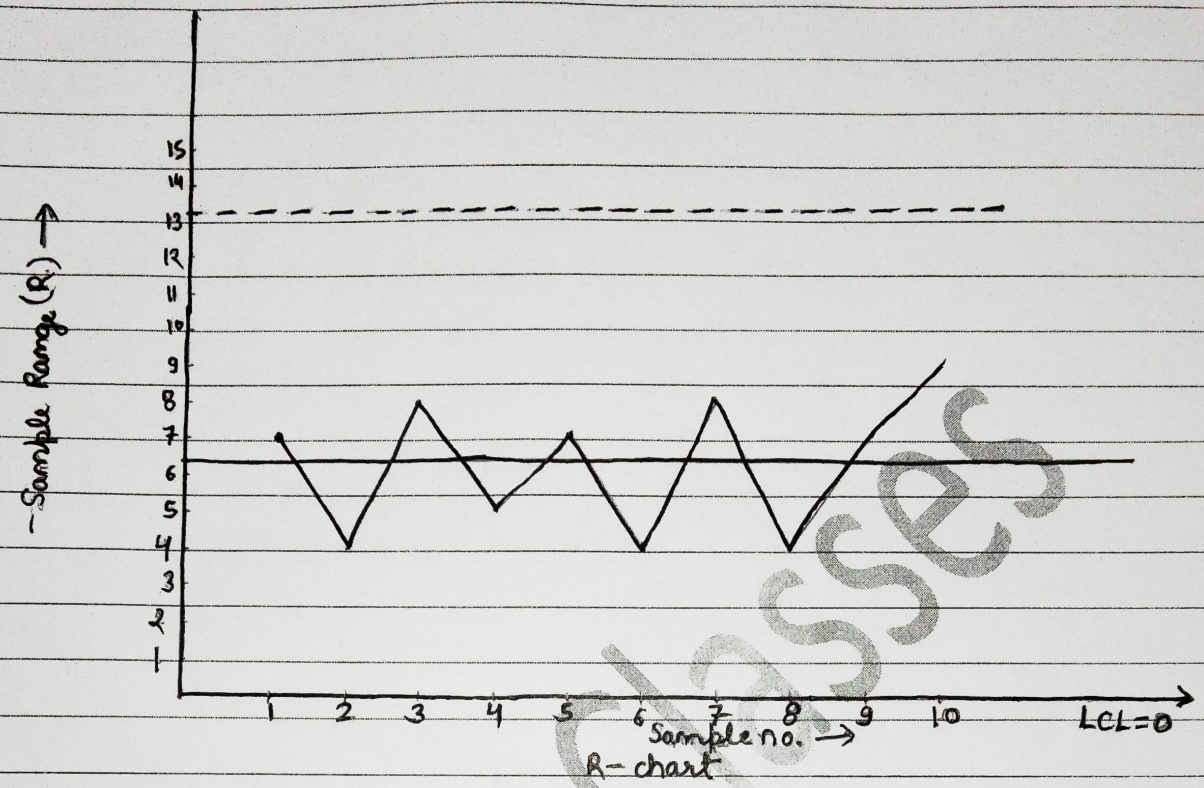
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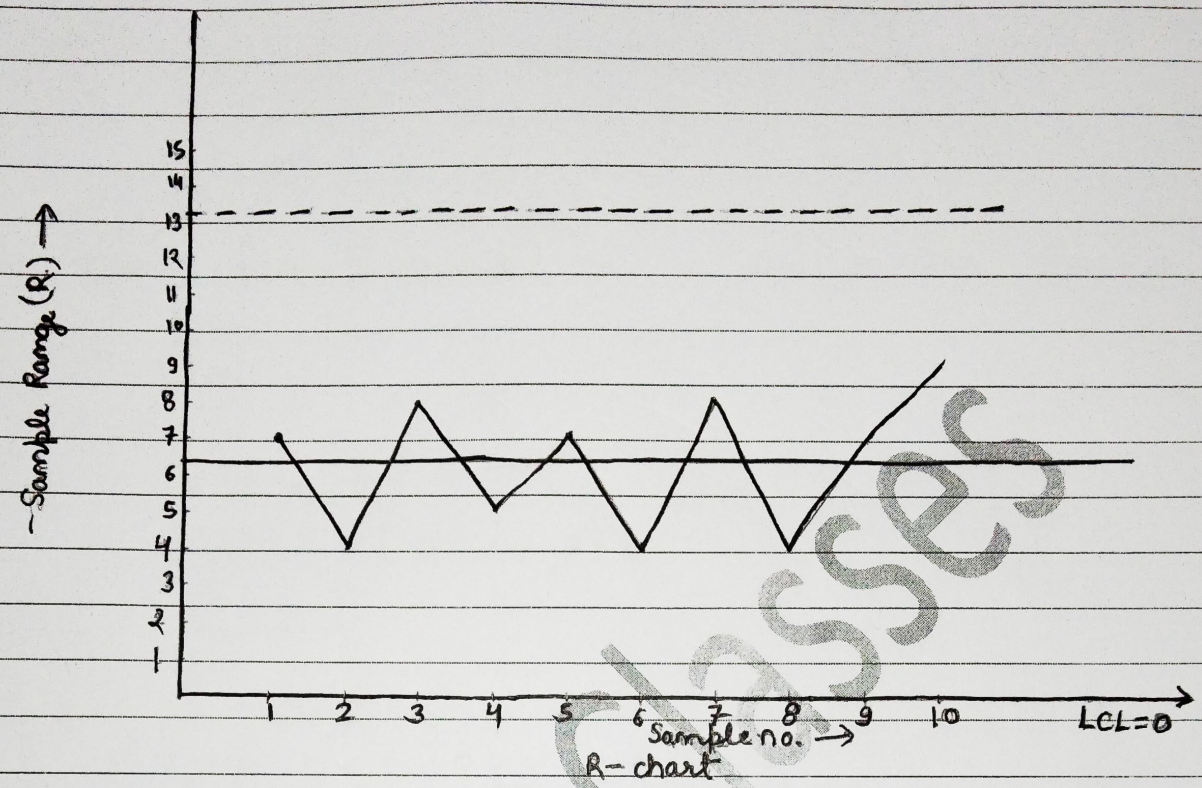
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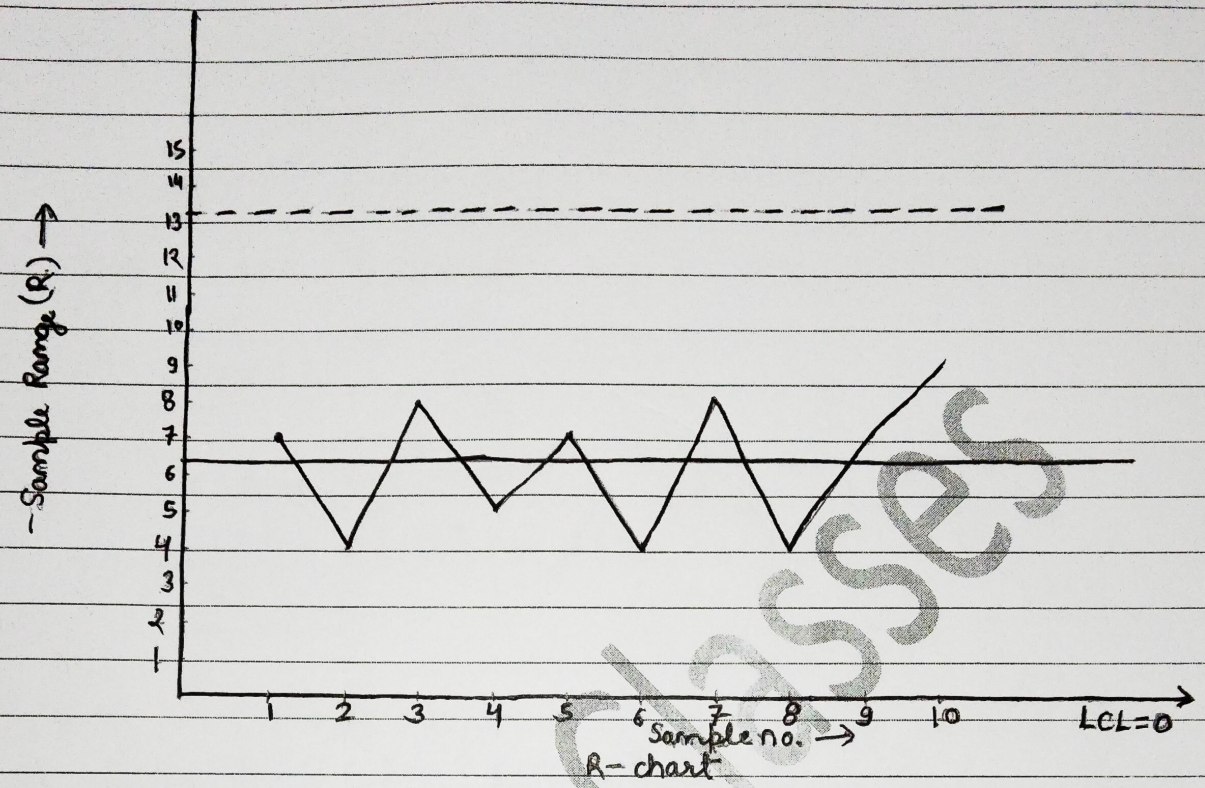
$A_2 = 1.02$, $D_4 = 2.57$, $D_3 = 0$

$$\bar{\bar{X}} = \frac{0.494 + 0.496 + 0.500 + 0.505 + 0.499}{5}$$

$$\bar{\bar{X}} \doteq 0.4988$$

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$$\bar{R} = \frac{\Sigma R}{n} = \frac{0.017 + 0.005 + 0.028 + 0.022 + 0.018}{5}$$

$$= 0.018$$

Control limits for $\bar{x}$ chart -

$$\boxed{CL_{\bar{x}} = 0.4988}$$

$$UCL_{\bar{x}} = \bar{\bar{x}} + A_2 \bar{R}$$

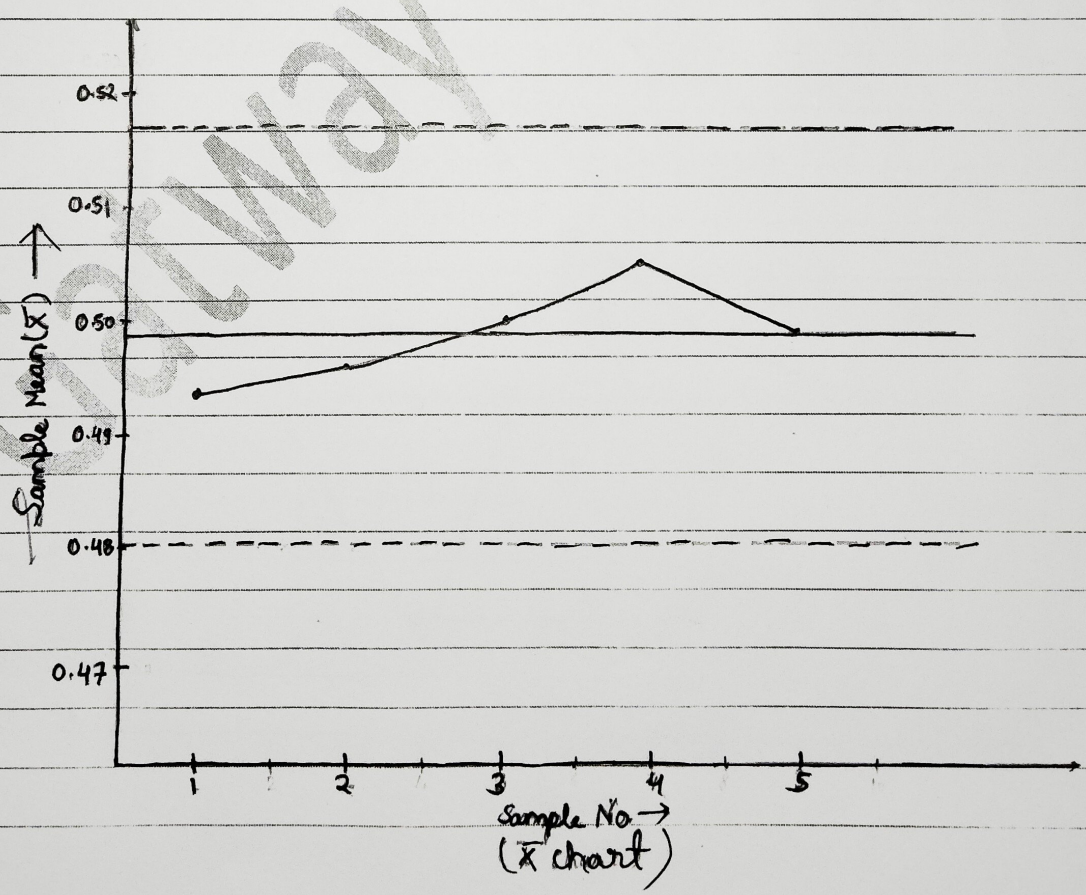
$$= 0.4988 + 1.02 \times 0.018$$

$$\boxed{UCL_{\bar{x}} = 0.5172}$$

$$LCL_{\bar{x}} = \bar{\bar{x}} - A_2 \bar{R}$$

$$= 0.4988 - 1.02 \times 0.018$$

$$\boxed{LCL_{\bar{x}} = 0.4804}$$



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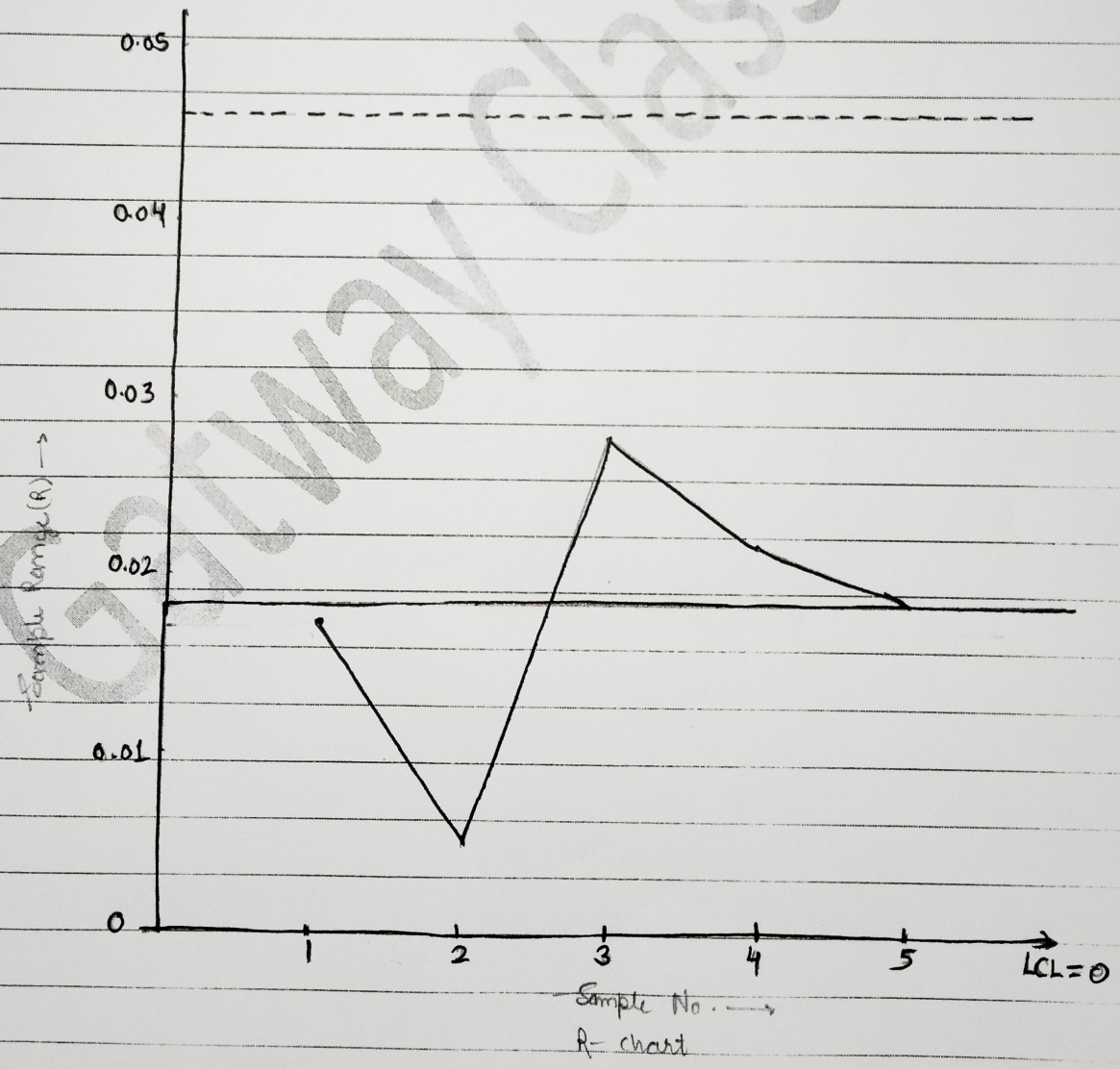
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Control limits of R-chart :

$$CL = \bar{R} = 0.018$$

$$UCL_R = D_4 \bar{R}$$
$$= 2.57 \times 0.018$$
$$UCL_R = 0.0462$$

$$LCL_R = D_3 \bar{R}$$
$$LCL_R = 0$$



R- chart

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