

# **ME370: ADAMS LAB**

**Department of Mechanical Engineering,  
IIT Bombay**

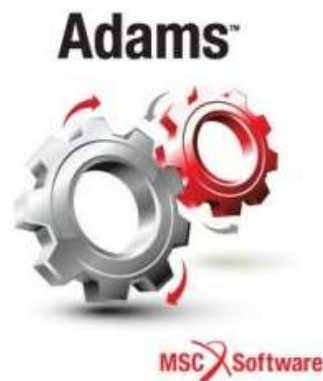


## **Session 7 Report**

**Group / Section: A8**

**Name: Ameya Halarikar**

**Roll Number: 200020023**

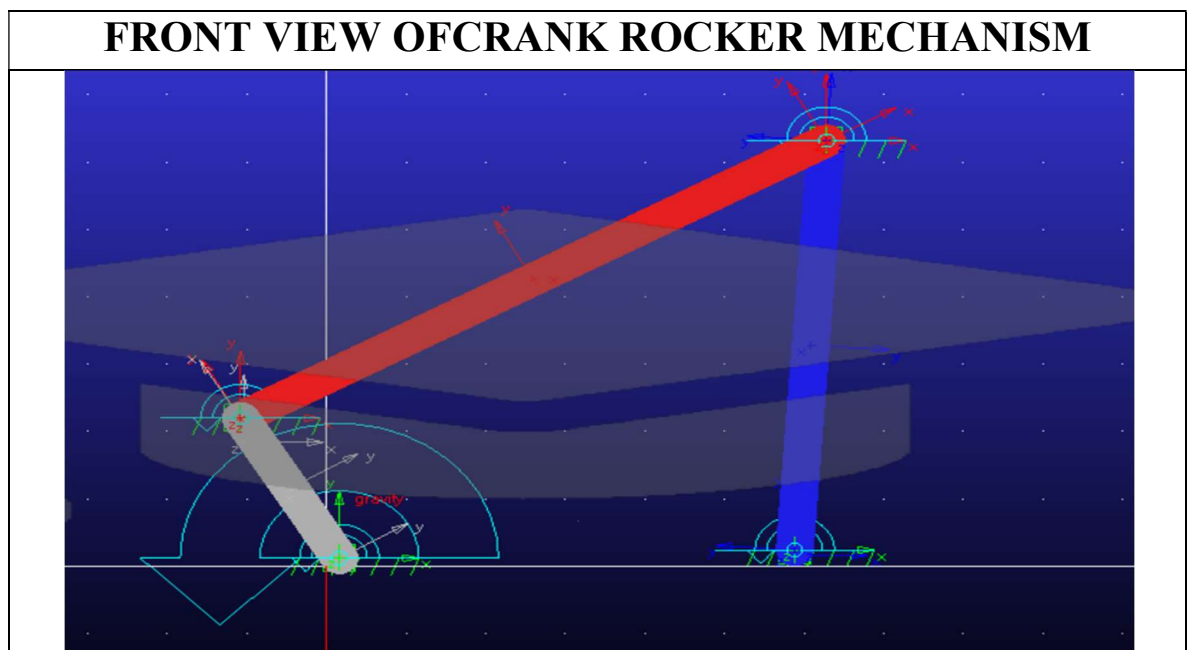


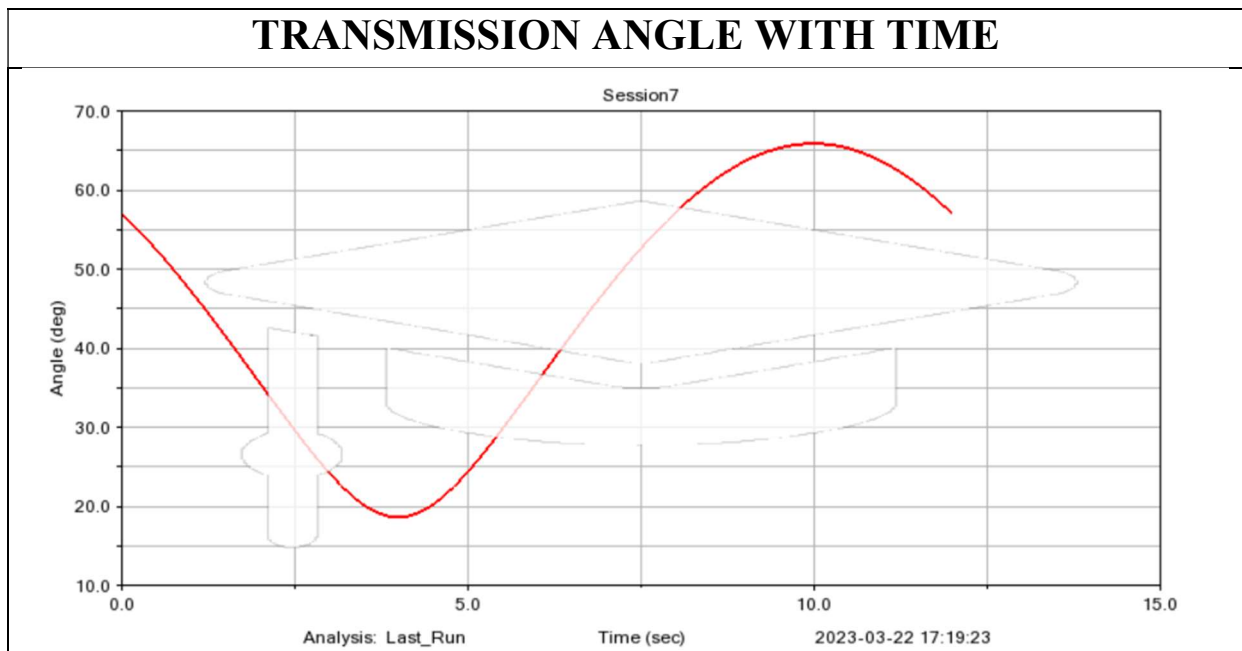
**Date: March 17, 2023**

## Given Information

Roll Number	Coordinates of Joints (mm)							
200020023	A(x)	A(y)	B(x)	B(y)	C(x)	C(y)	D(x)	D(y)
Question 1 Data	8	6	-54	110	314	316	294	12
Question 2 Data	Ball Diameter (cm)	Ball Mass (X kg)	Vertical Distance between Centre of Ball and Centre of Basket (Y cm)		Horizontal Distance between Centre of Ball and Centre of Basket (Z cm)		Torus Major Diameter (cm)	Torus Minor Diameter (cm)
	14	19	67		90		21	19

## Question 1 (Crank Rocker Mechanism)





## INPUTS:

- The maximum change in coordinate positions of B and C is constrained to 15%.

## SENSITIVITY ANALYSIS

JOINT	IMAGE	AVERAGE SENSITIVITY																								
B(x)	<div>Design Study Summary</div> <div>Model Name : Session7</div> <div>Date Run : 2023-03-22 17:27:17</div> <div>Objectives</div> <div>01) Minimum of MEA_ANGLE_1</div> <div>Units : deg</div> <div>Maximum Value: 28.2682 (trial 1)</div> <div>Minimum Value: 25.7013 (trial 5)</div> <div>Design Variables</div> <div>V1) DV_5</div> <div>Units : mm</div> <table><tr><th>Trial</th><th>MEA_ANGLE_1</th><th>DV_5</th><th>Sensitivity</th></tr><tr><td>1</td><td>28.268</td><td>-39.015</td><td>0.17010</td></tr><tr><td>2</td><td>27.683</td><td>-42.457</td><td>0.17562</td></tr><tr><td>3</td><td>27.059</td><td>-45.900</td><td>0.18662</td></tr><tr><td>4</td><td>26.398</td><td>-49.342</td><td>0.19721</td></tr><tr><td>5</td><td>25.701</td><td>-52.785</td><td>0.20231</td></tr></table>	Trial	MEA_ANGLE_1	DV_5	Sensitivity	1	28.268	-39.015	0.17010	2	27.683	-42.457	0.17562	3	27.059	-45.900	0.18662	4	26.398	-49.342	0.19721	5	25.701	-52.785	0.20231	0.18637
Trial	MEA_ANGLE_1	DV_5	Sensitivity																							
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5	25.701	-52.785	0.20231																							
B(y)	<div>Design Study Summary</div> <div>Model Name : Session7</div> <div>Date Run : 2023-03-22 17:28:57</div> <div>Objectives</div> <div>01) Minimum of MEA_ANGLE_1</div> <div>Units : deg</div> <div>Maximum Value: 28.2125 (trial 5)</div> <div>Minimum Value: 25.7491 (trial 1)</div> <div>Design Variables</div> <div>V1) DV_6</div> <div>Units : mm</div> <table><tr><th>Trial</th><th>MEA_ANGLE_1</th><th>DV_6</th><th>Sensitivity</th></tr><tr><td>1</td><td>25.749</td><td>107.52</td><td>0.070742</td></tr><tr><td>2</td><td>26.420</td><td>117.01</td><td>0.069035</td></tr><tr><td>3</td><td>27.059</td><td>126.50</td><td>0.065363</td></tr><tr><td>4</td><td>27.661</td><td>135.99</td><td>0.060786</td></tr><tr><td>5</td><td>28.212</td><td>145.47</td><td>0.058174</td></tr></table>	Trial	MEA_ANGLE_1	DV_6	Sensitivity	1	25.749	107.52	0.070742	2	26.420	117.01	0.069035	3	27.059	126.50	0.065363	4	27.661	135.99	0.060786	5	28.212	145.47	0.058174	0.06482
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C(x)	<div>Design Study Summary</div> <div>Model Name : Session7</div> <div>Date Run : 2023-03-22 17:30:01</div> <div>Objectives</div> <div>01) Minimum of MEA_ANGLE_1</div> <div>Units : deg</div> <div>Maximum Value: 28.9069 (trial 1)</div> <div>Minimum Value: 24.904 (trial 5)</div> <div>Design Variables</div> <div>V1) DV_7</div> <div>Units : mm</div> <table><tr><th>Trial</th><th>MEA_ANGLE_1</th><th>DV_7</th><th>Sensitivity</th></tr><tr><td>1</td><td>28.907</td><td>226.86</td><td>-0.044549</td></tr><tr><td>2</td><td>28.015</td><td>246.88</td><td>-0.046156</td></tr><tr><td>3</td><td>27.059</td><td>266.90</td><td>-0.049645</td></tr><tr><td>4</td><td>26.028</td><td>286.92</td><td>-0.053828</td></tr><tr><td>5</td><td>24.904</td><td>306.93</td><td>-0.056131</td></tr></table>	Trial	MEA_ANGLE_1	DV_7	Sensitivity	1	28.907	226.86	-0.044549	2	28.015	246.88	-0.046156	3	27.059	266.90	-0.049645	4	26.028	286.92	-0.053828	5	24.904	306.93	-0.056131	-0.05006
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C(y)

Design Study Summary

Model Name : Session7

Date Run : 2023-03-22 17:30:54

Objectives

01) Minimum of MEA\_ANGLE\_1

Units : deg

Maximum Value: 28.6568 (trial 5)

Minimum Value: 24.6041 (trial 1)

Design Variables

V1) DV\_8

Units : mm

Trial	MEA_ANGLE_1	DV_8	Sensitivity
1	24.604	308.89	0.050194
2	25.972	336.15	0.045037
3	27.059	363.40	0.036051
4	27.937	390.65	0.029311
5	28.657	417.91	0.026399

0.03740

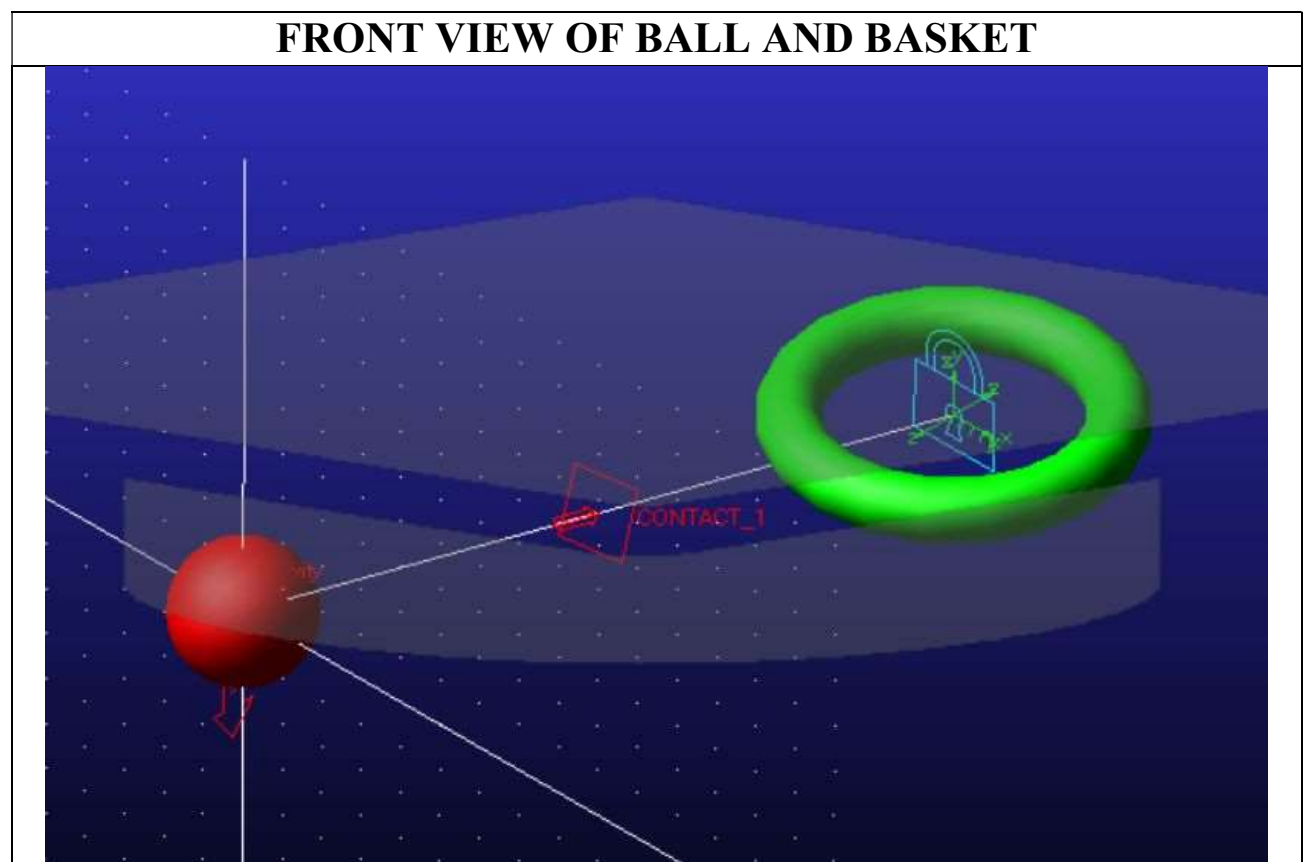
POSITION OPTIMISATION ANALYSIS																																									
<p>Optimization Summary</p> <p>Model Name : Session7 Date Run : 2023-03-22 17:21:22</p> <p>Objectives</p> <p>01) Minimum of MEA_ANGLE_1 Units : deg Initial Value: 18.6635 Final Value : 27.059 (+45%)</p> <p>Design Variables</p> <p>V1) DV_5 Units : mm Initial Value: -54 Final Value : -45.9 (-15%)</p> <p>V2) DV_6 Units : mm Initial Value: 110 Final Value : 126.5 (+15%)</p> <p>V3) DV_7 Units : mm Initial Value: 314 Final Value : 266.9 (-15%)</p> <p>V4) DV_8 Units : mm Initial Value: 316 Final Value : 363.4 (+15%)</p> <table> <tr> <th>Iter.</th><th>MEA_ANGLE_1</th><th>DV_5</th><th>DV_6</th><th>DV_7</th><th>DV_8</th></tr> <tr> <td>0</td><td>18.663</td><td>-54.000</td><td>110.00</td><td>314.00</td><td>316.00</td></tr> <tr> <td>1</td><td>26.684</td><td>-45.900</td><td>120.87</td><td>266.90</td><td>363.40</td></tr> <tr> <td>2</td><td>26.050</td><td>-45.900</td><td>126.50</td><td>286.50</td><td>363.40</td></tr> <tr> <td>3</td><td>26.040</td><td>-45.900</td><td>126.50</td><td>286.69</td><td>363.40</td></tr> <tr> <td>4</td><td>27.059</td><td>-45.900</td><td>126.50</td><td>266.90</td><td>363.40</td></tr> </table>						Iter.	MEA_ANGLE_1	DV_5	DV_6	DV_7	DV_8	0	18.663	-54.000	110.00	314.00	316.00	1	26.684	-45.900	120.87	266.90	363.40	2	26.050	-45.900	126.50	286.50	363.40	3	26.040	-45.900	126.50	286.69	363.40	4	27.059	-45.900	126.50	266.90	363.40
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## OUTPUTS:

- The magnitude of sensitivity at different joints is according to the order:  $B(x) > B(y) > C(x) > C(y)$
- The optimum positions of B and C which will give the maximum value for the minimum transmission angle encountered during a crank rotation have been indicated in Optimization Summary.

Maximum Value of Minimum Transmission Angle	Optimum coordinates of Joint B	Optimum coordinates of Joint C
27.059	(-45.9,126.5)	(266.9,363.4)

## Question 2 (Basketball Hoop Problem)



## POSITION & VELOCITY OPTIMISATION ANALYSIS

### Optimization Summary

Model Name : AmeyaS7Q2

Date Run : 2023-03-22 18:07:31

### Objectives

O1) Minimum of MEA\_PT2PT\_1

Units : mm

Initial Value: 24.0228

Final Value : 0.475698 (-98%)

### Design Variables

V1) DV\_1

Units : mm/sec

Initial Value: 1500

Final Value : 1514.21 (+0.947%)

V2) DV\_2

Units : mm/sec

Initial Value: 3900

Final Value : 3917.85 (+0.458%)

Iter.	MEA_PT2PT_1	DV_1	DV_2
0	24.023	1500.0	3900.0
1	5.4864	1512.6	3915.9
2	8.7073	1514.7	3921.1
3	10.763	1515.6	3920.9
4	0.47570	1514.2	3917.8

## OUTPUTS:

Optimum X Velocity	Optimum Y Velocity	Optimum Z Velocity
1.514 m/s	3.917 m/s	0

—X—X—X—X—X—X—X—X—**END**—X—X—X—X—X—X—X—X—