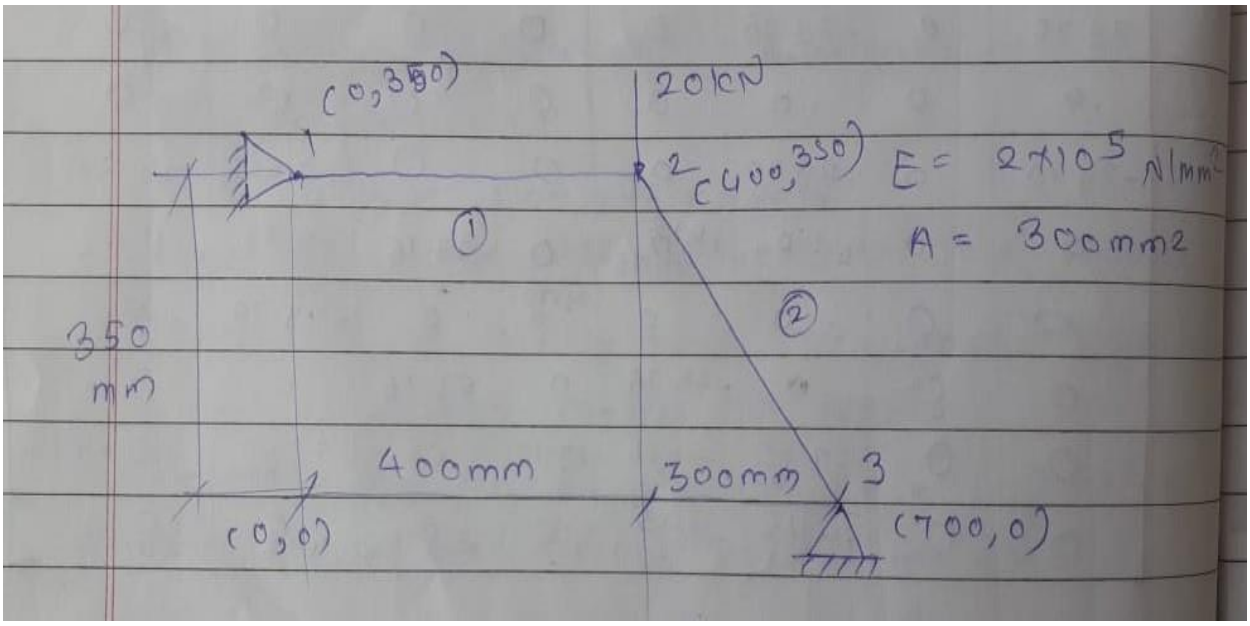
Name of Student: Aniket Patil	**Class: TE MECH 2**
Sem/Year: 6th/ 3rd	**Roll no: 29**
Date of performance	**Date of Submission:**
Examined by: Prof. B.R Pujari	**Expt No: 2**

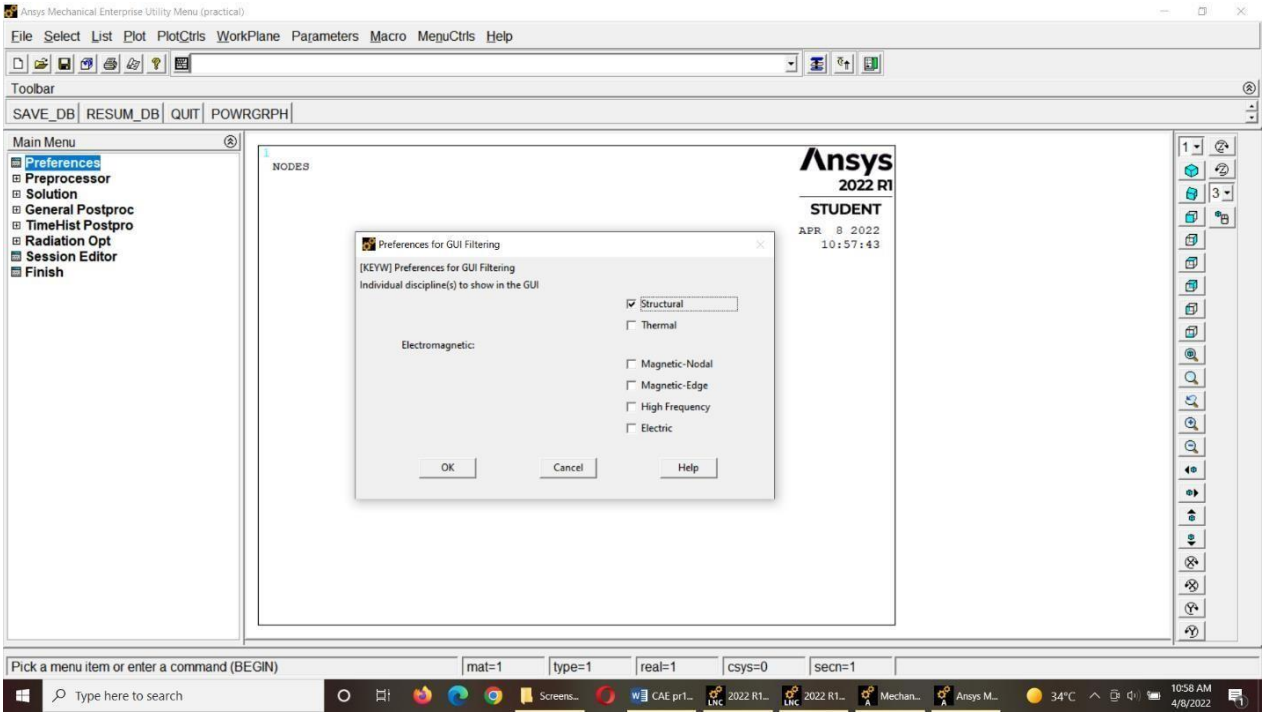
AIM OF EXPERIMENT:-Stress and deflection analysis of truss using finite element package. Finite Element Package: ANSYS 2022

Stress distribution in truss with applied load.

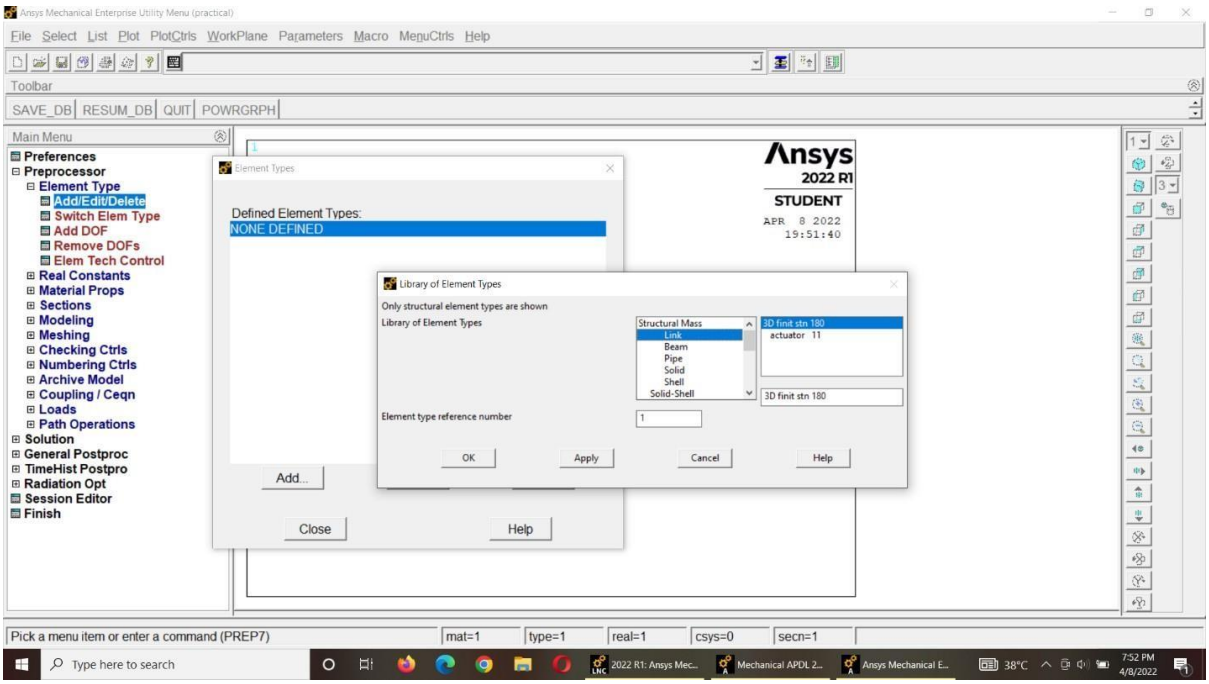


E= 2x10e5 Mpa **R= 25mm** **u= 0.3**

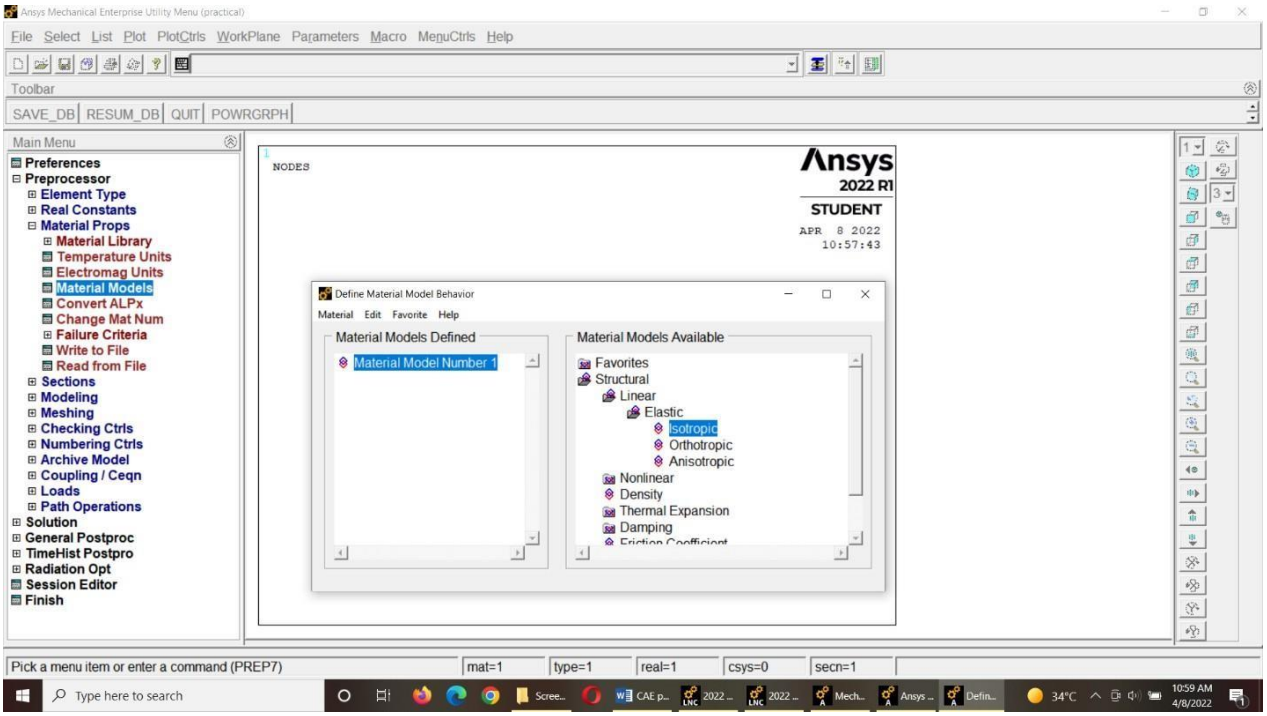
Step 1: Select type of Analysis ---------- Preferences> structural>Press Ok



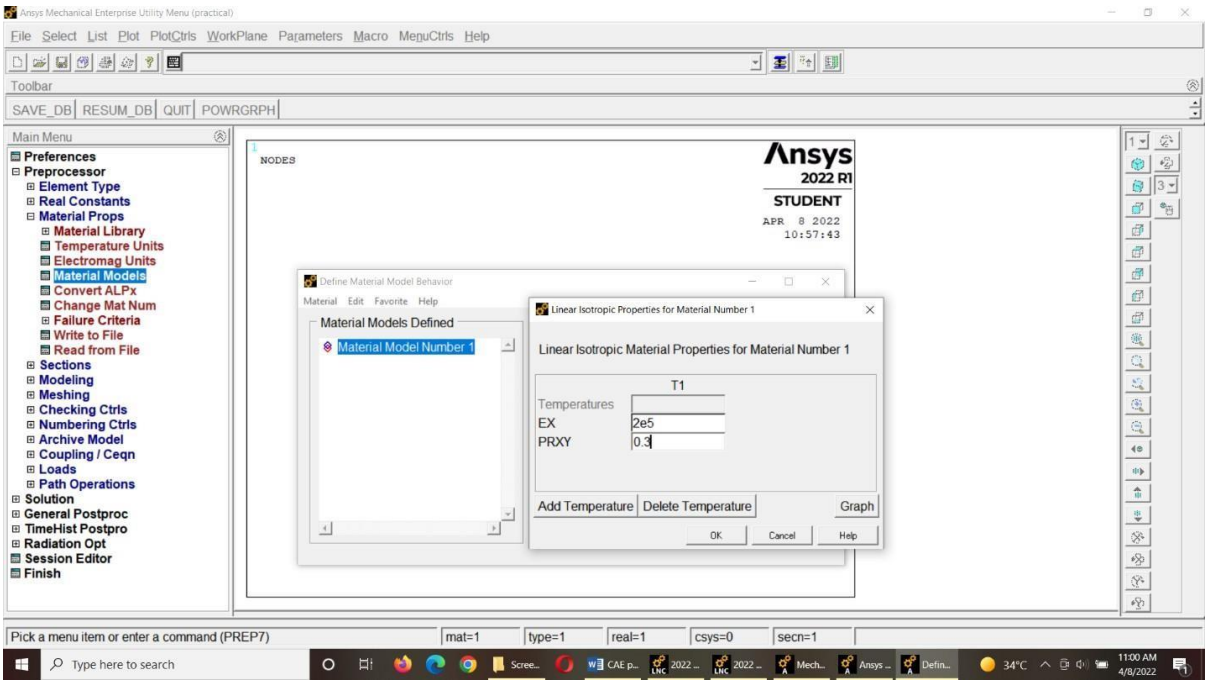
Step 2: Add the element type……preprocessor>element type>link>3D finit 180> Press ok



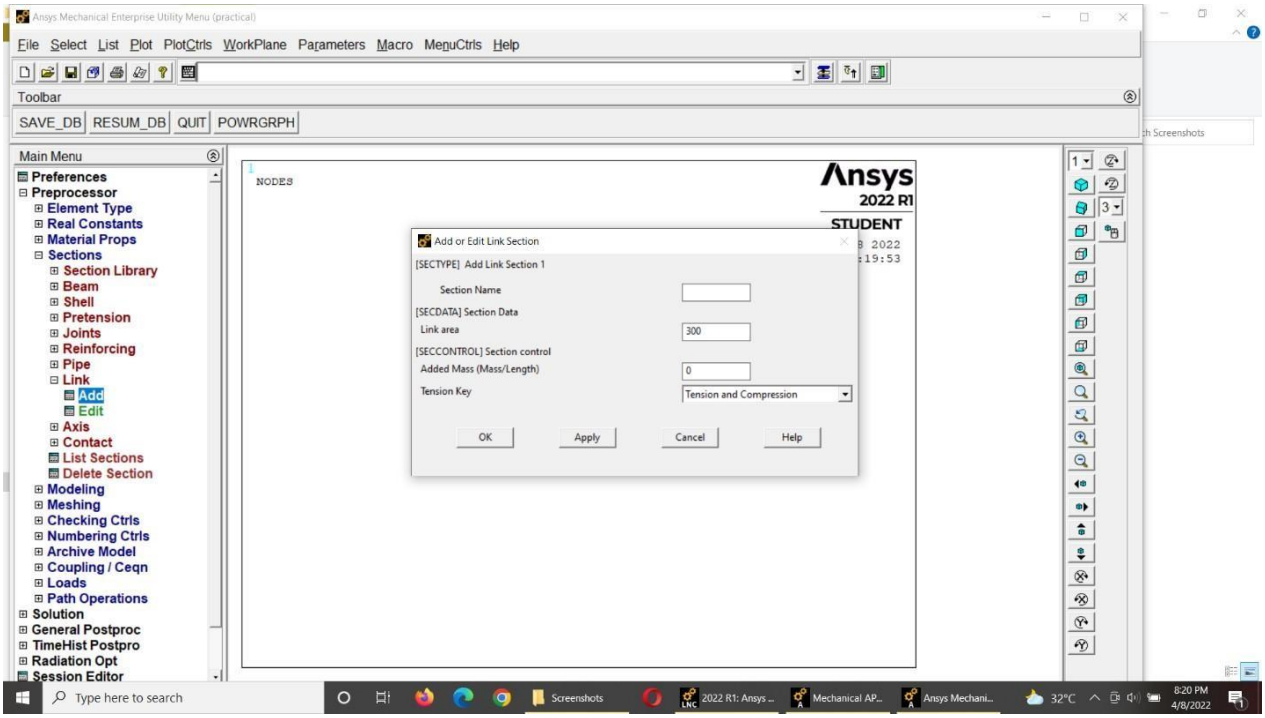
Step 3: Preprocessor>Material prop.>Material models>Material number1



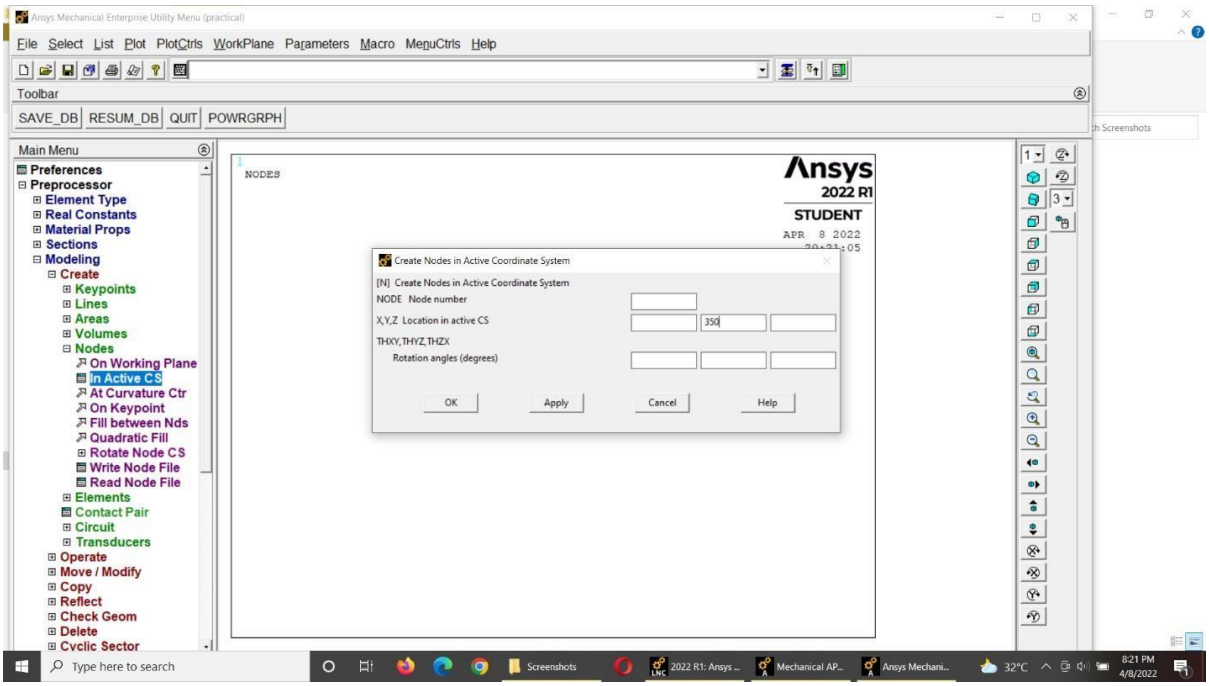
Step 4: Material models>structural>linear>elastic>isotropic.



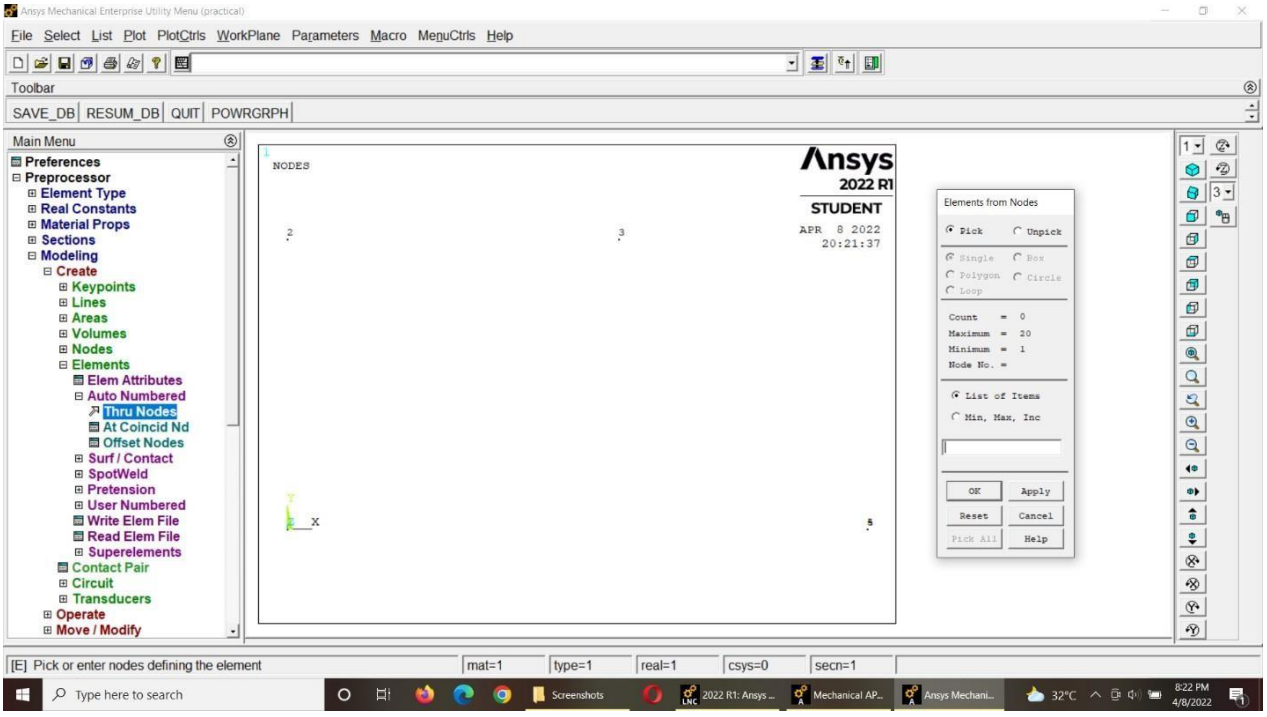
Step 5: selecting section of link….section>link>add>apply> type area of link> ok.

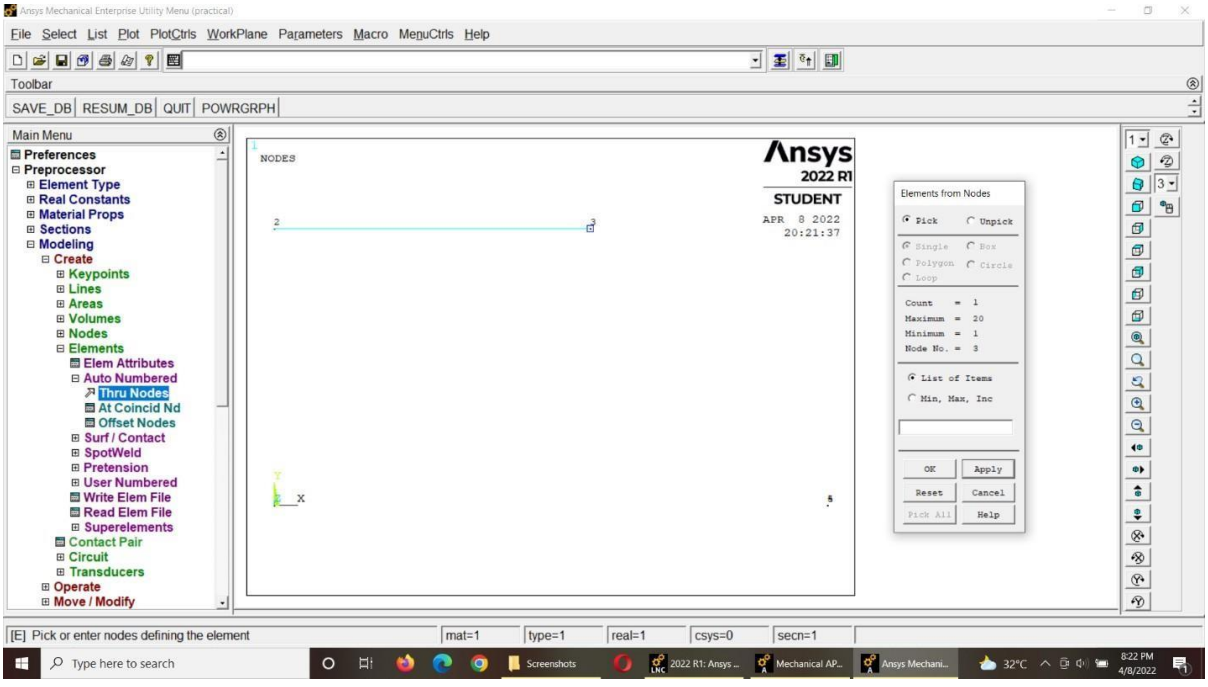


Step6: Creating Keypoints:- modeling>create>nodes>in active cs>select co- ordinate.

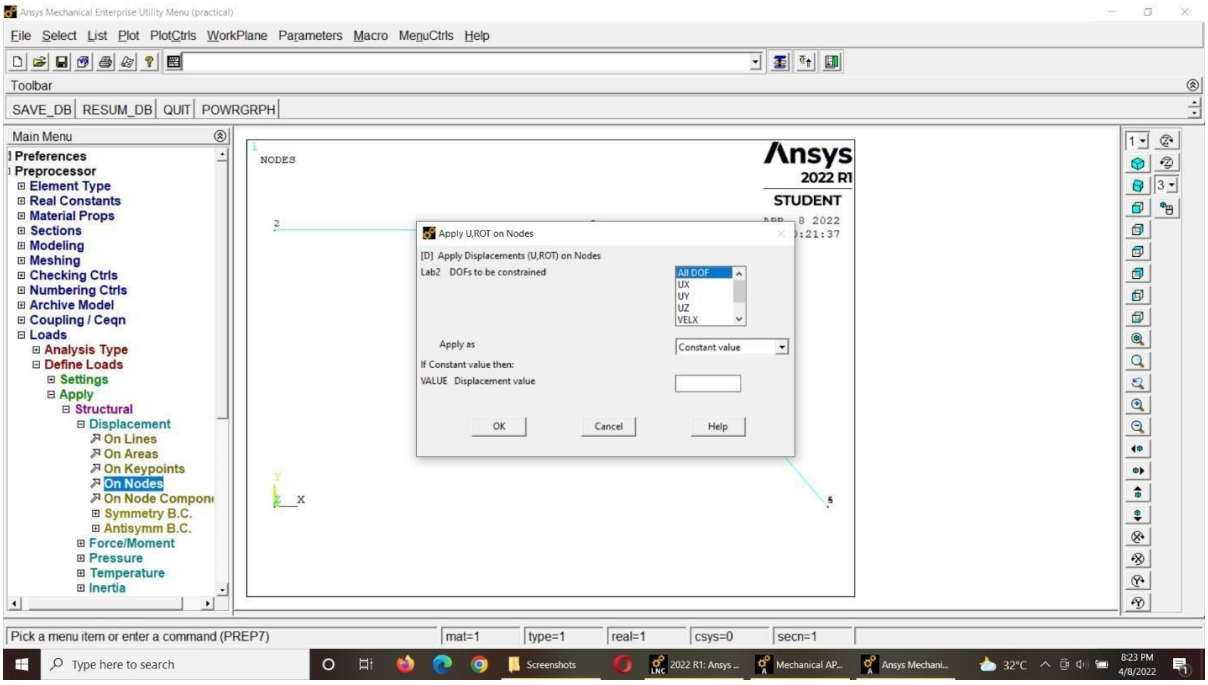


Step7: modeling>create>elements>auto numbered>thru nodes>select nodes one by one joining.

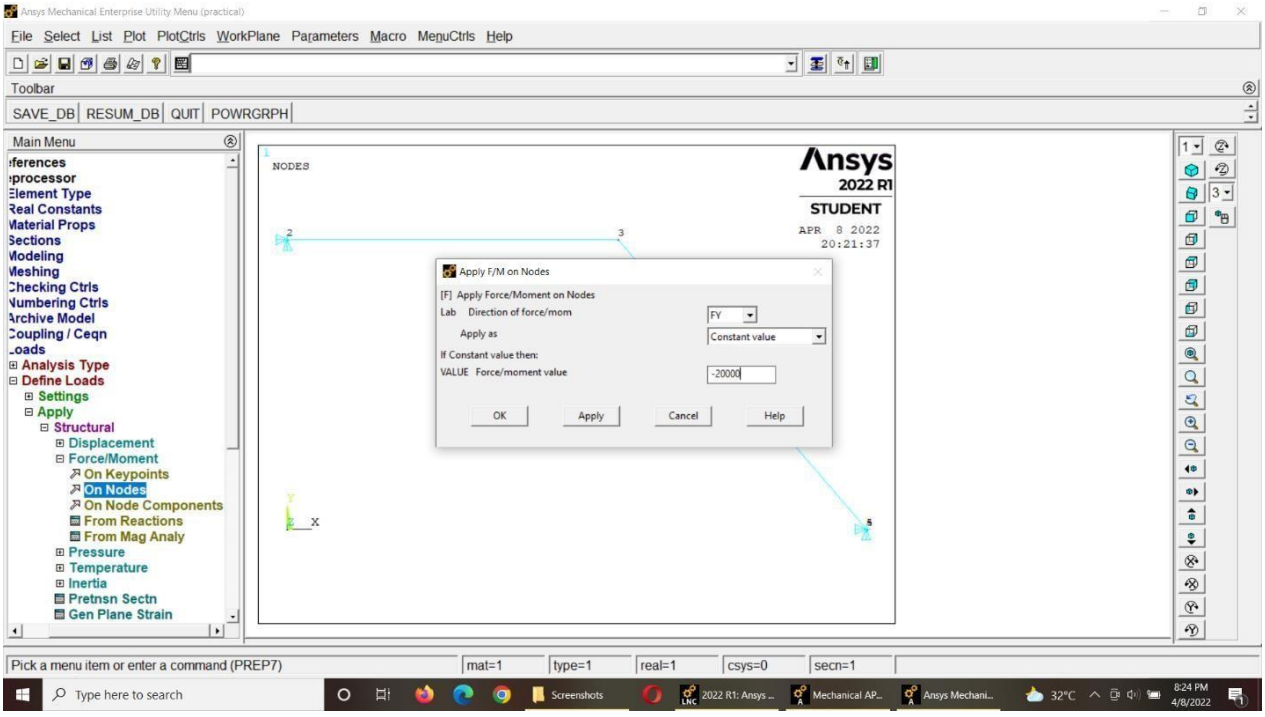




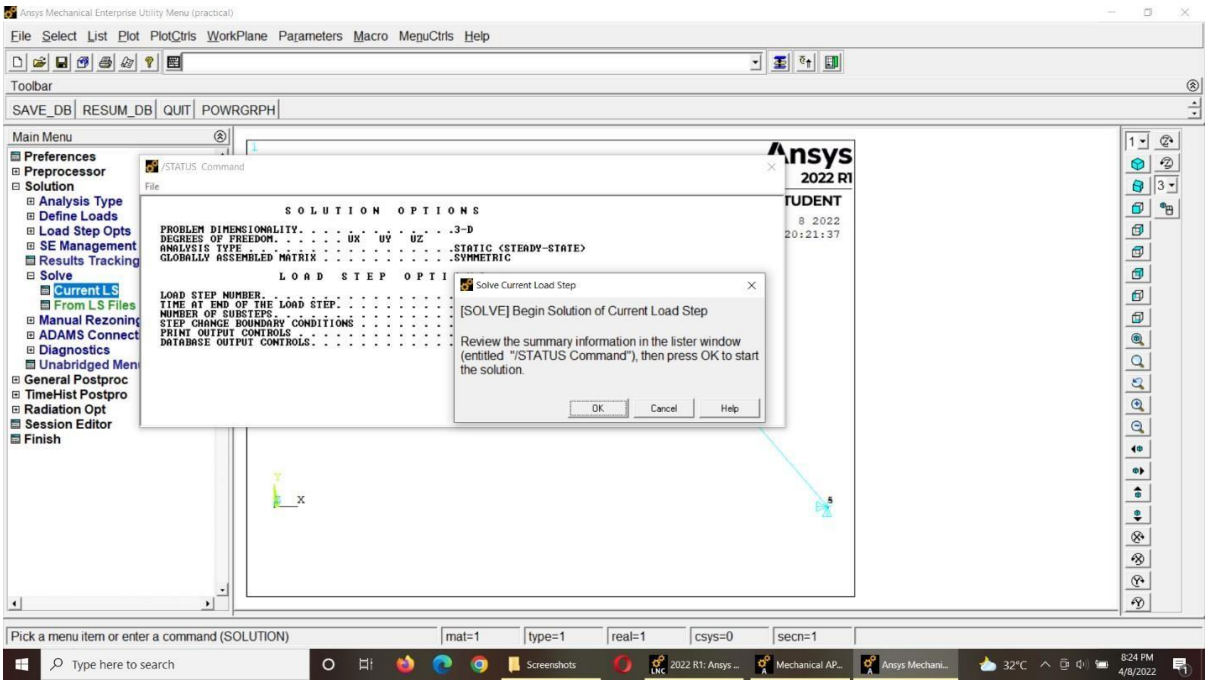
Step8: Apply loads: Laods>define loads>apply>structural>displacement>on nodes> All Dof>0>ok



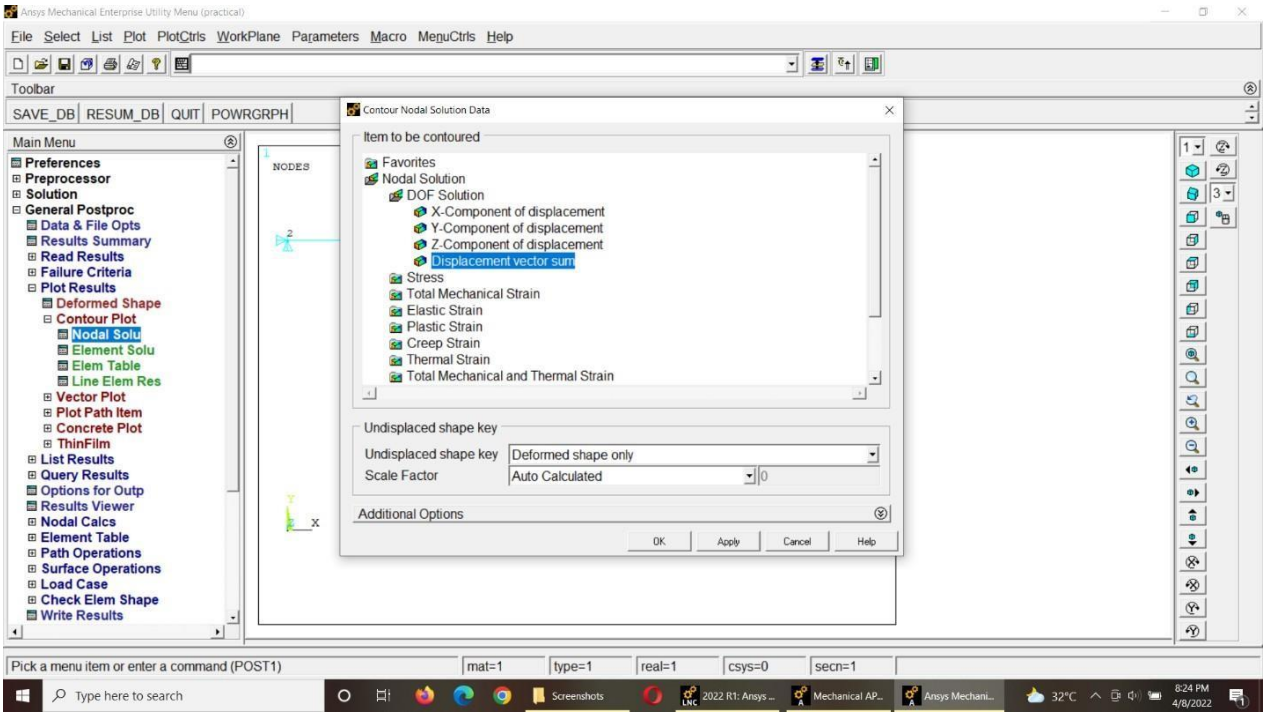
Step11: Loads>Define loads>apply>forces>on keypoints> selecting direction of forces (here FY in –ve)>ok



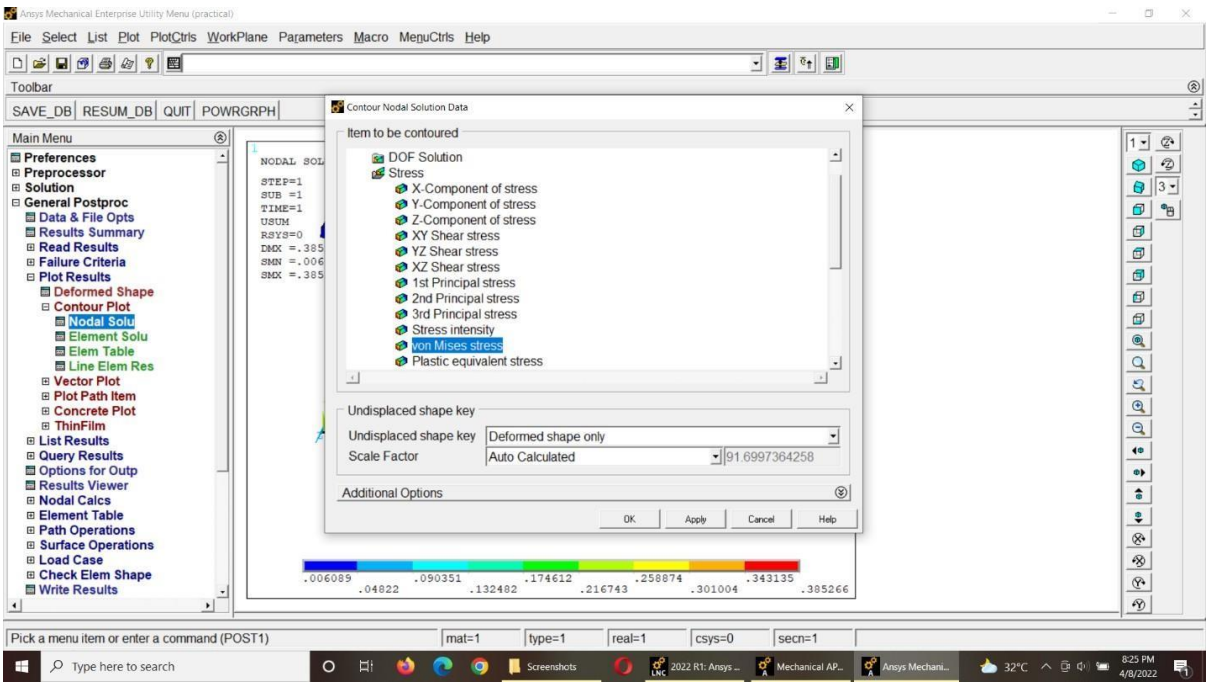
Step12:Solution:- solution>solve>currentls> done



Step13: General postproc> plot result> Nodal solution> Dof >Vector sum displacement> apply.

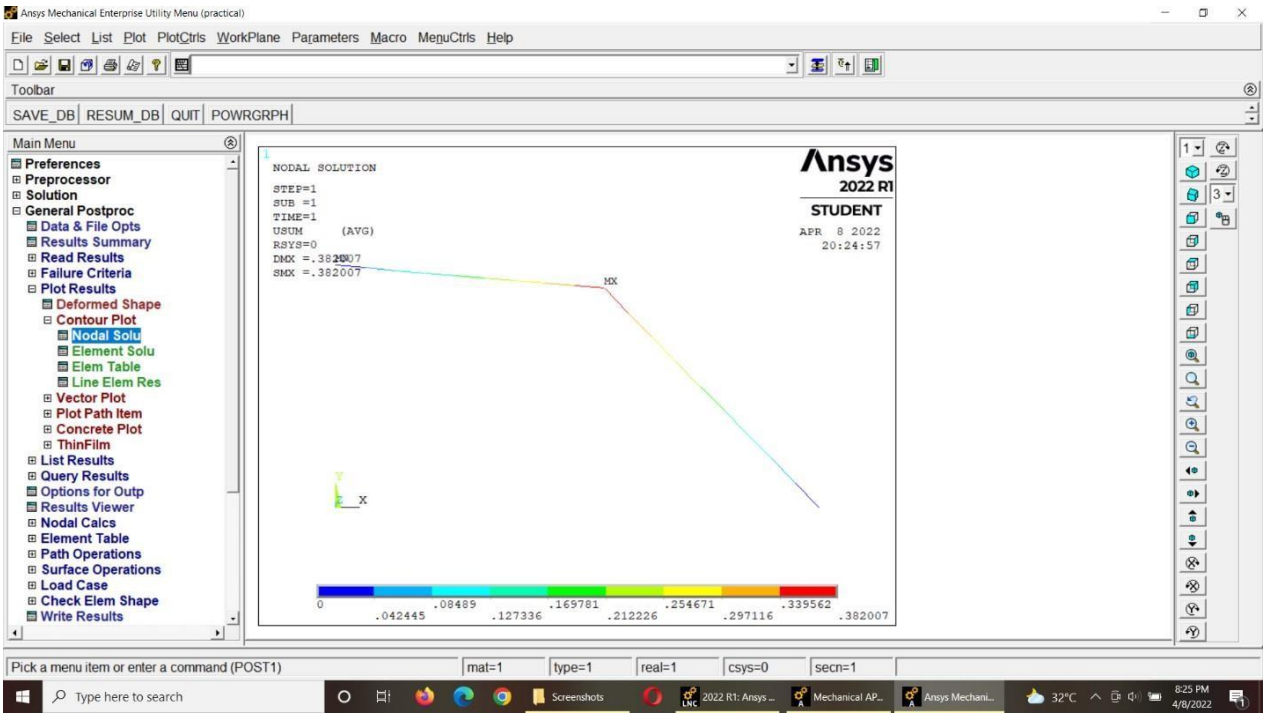


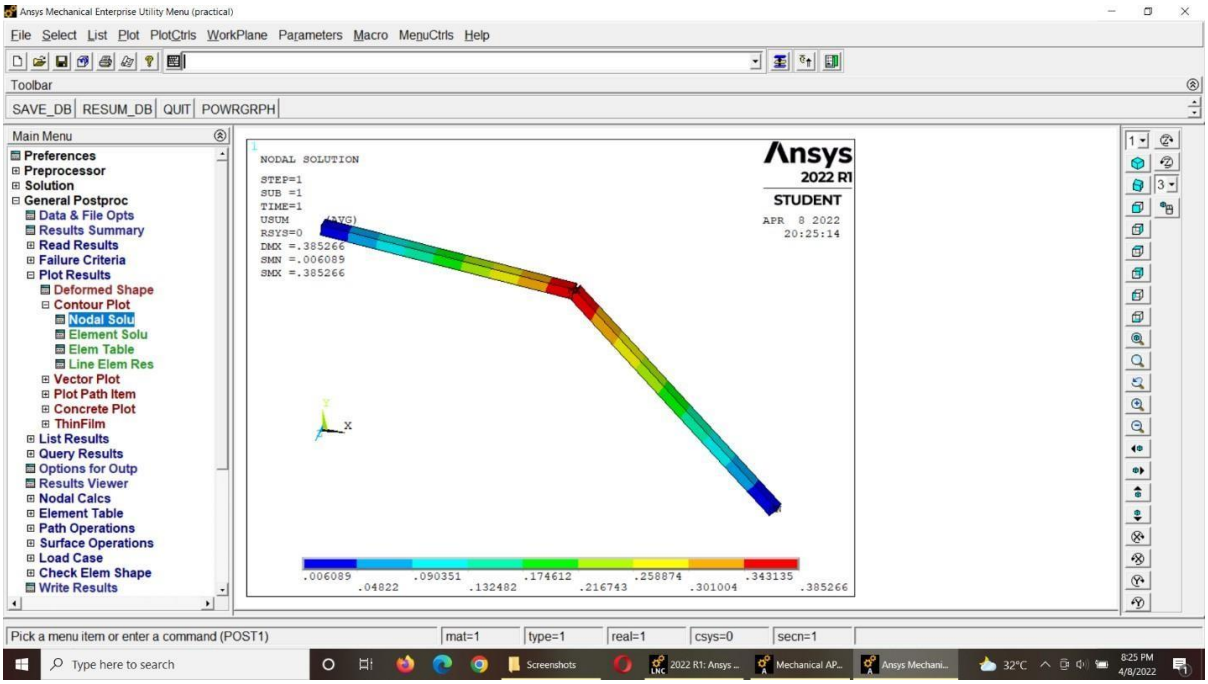
Step14: Nodal solution> stress> von misses stress> apply



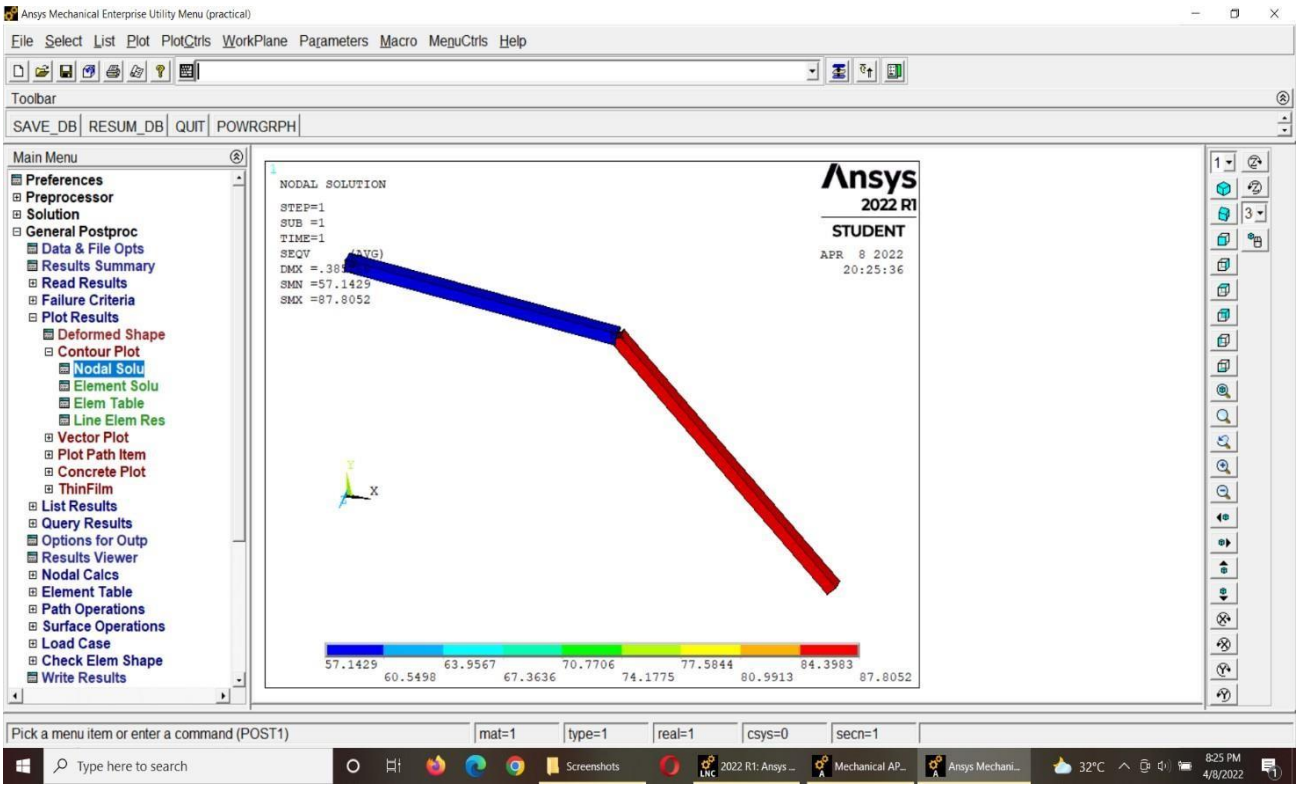
RESULTS:-

NODAL DISPLACEMENT:-





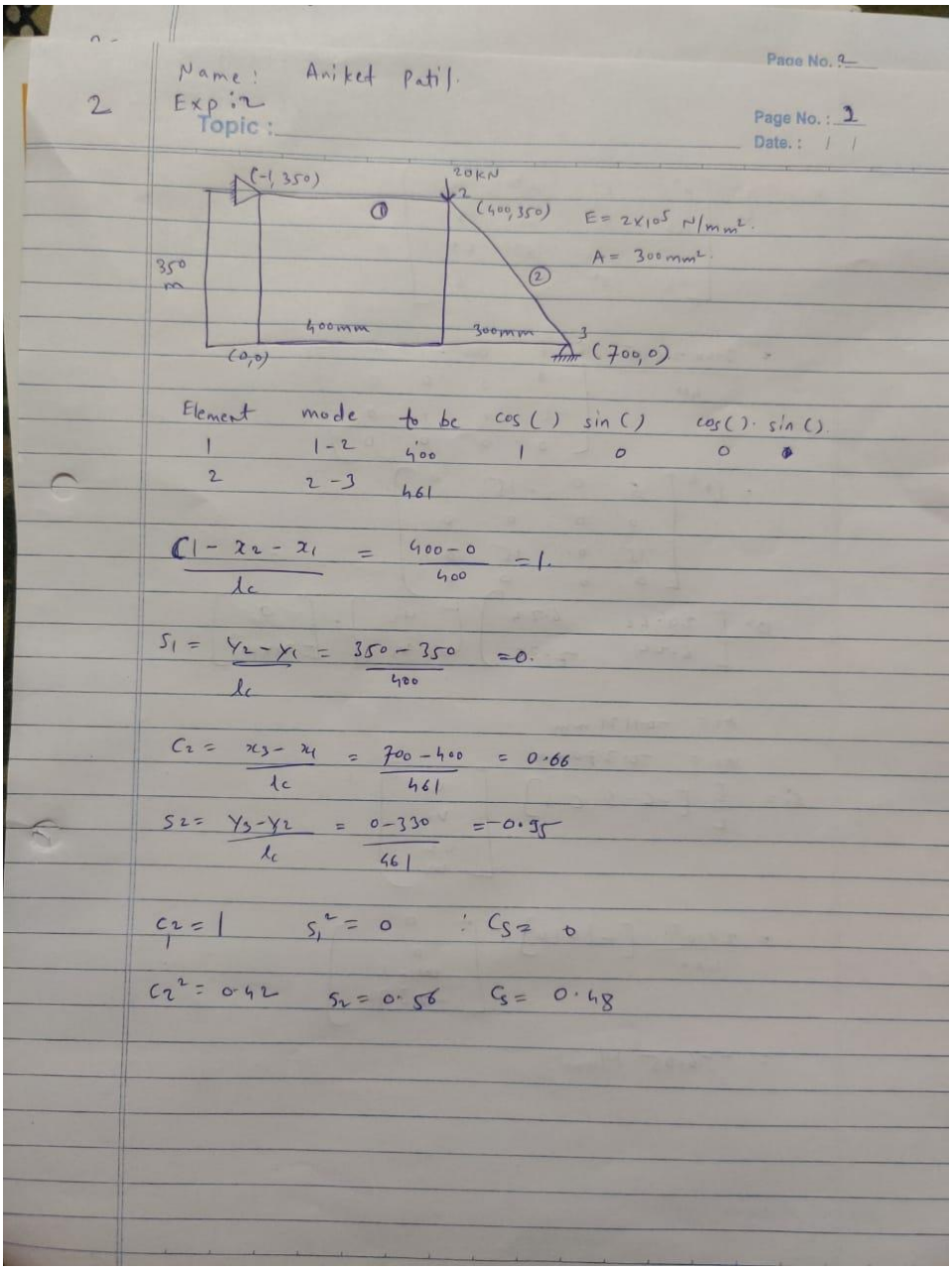
STRESSES:-



SO HERE BY ANALYSIS WE HAVE GOT MAX. INDUCED STRESS IS 87.8052N/MM2

MIN.STRESSES ARE 57.14N/MM2 AND MAXIMUM DEFORMATION IS 0.3852MM

BY analytical solution:-



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Element	node	to be	cos ( )	sin ( )	cos ( ) · sin ( )
1	1-2	400	1	0	0
2	2-3	461			

$$\frac{x_2 - x_1}{l_e} = \frac{400 - 0}{400} = 1.$$

$$S_1 = \frac{Y_2 - Y_1}{l_e} = \frac{350 - 350}{400} = 0.$$

$$C_2 = \frac{x_3 - x_1}{l_e} = \frac{700 - 400}{461} = 0.66$$

$$S_2 = \frac{Y_3 - Y_2}{l_e} = \frac{0 - 350}{461} = -0.95$$

$C_2 = 1$ $\quad S_1^2 = 0$ $\quad \therefore C_S = 0$

$C_2^2 = 0.42$ $\quad S_2 = 0.56$ $\quad C_S = 0.48$

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$$X_1 = \frac{AE}{L}\begin{bmatrix} c^2 & cs & -c^2 & -cs \\ cs & s^2 & -cs & -s^2 \\ -c^2 & -cs & c^2 & cs \\ -cs & -s^2 & cs & s^2 \end{bmatrix}$$

$$= \frac{300 \times 2 \times 10^5}{400}\begin{bmatrix} 1 & 0 & -1 & 0 \\ 0 & 0 & 0 & 0 \\ -1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$= 10^4\begin{bmatrix} 5 & 0 & -15 & 0 \\ 0 & 0 & 0 & 0 \\ -15 & 0 & 15 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$10^4\begin{bmatrix} 20.46 & 6.24 \\ 6.24 & 7.28 \end{bmatrix}\begin{bmatrix} u_2 \\ v_1 \end{bmatrix} = \begin{bmatrix} 0 \\ -20\times10^3 \end{bmatrix}$$

$u_2 = -0.1121$ mm

$v_2 = -0.370$ mm

$$\sigma_1 = \frac{E}{L}\begin{bmatrix} -c & -s & c & s \end{bmatrix}\begin{bmatrix} u_1 \\ v_1 \\ u_2 \\ v_2 \end{bmatrix}$$

$$= \frac{2\times10^5}{400}\begin{bmatrix} -1 & 0 & 1 & 0 \end{bmatrix}\begin{bmatrix} 0 \\ 0 \\ -0.112 \\ -0.370 \end{bmatrix}$$

$= -56.05$ N/mm^2.

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$$\sigma_2 = \frac{E}{L}\begin{bmatrix} -C & -S & C & S \end{bmatrix}\begin{bmatrix} u_1 \\ v_1 \\ u_2 \\ v_2 \end{bmatrix}$$

$$= 438.83\begin{bmatrix} -0.65 & -0.75 & 0.65 & 0.75 \end{bmatrix}\begin{bmatrix} -0.001 \\ -0.37 \\ 0 \\ 0 \end{bmatrix}$$

$$= -87.47 \text{ N/mm}^2.$$

CONCLUSION:-

Thus by comparing analytical and software solution we have got Max. stresses:-

By ansys solution:- 87.8052N/MM2 By analytical solution:- 87.47 N/mm2

Max. displacement:-

By ansys solution:- 0.3852MM

By analytical solution:- 0.370 mm

Thus we have got 1% & 4% error respectively in stress and displacement.