**NED UNIVERSITY OF ENGINEERING & TECHNOLOGY**

**Department of Civil Engineering**

CE 322 (Mechanics of Solids-II)

Complex Engineering Problem (Spring 2021)

| Name: | Roll No.: |
|---|---|
| Due on: Friday, 13th August 2021 | |

A. Develop a program in any convenient programming language or computational environment (Python, MATLAB etc.) that can be used to:

   i. find the principal stresses for the given state of stress.

   ii. find absolute maximum shear stress for the given state of stress.

   iii. find octahedral shear stress for the given state of stress.

   iv. find the strain tensor from given state of stress.

   v. find the principal strains for the given state of stress.

   vi. draw Mohr's circle of stress and strains.

   Use proper comments to define the input and output arguments, variables used and the calculations performed.

B. Modify the program developed in Problem # 1 so that it can be used to determine that the material has yielded or not according to (i) maximum principal stress theory, (ii) maximum shear stress theory, and (iii) maximum distortion energy theory.

C. Test the programs developed in A and B using following states of stress as input:

   i. $\begin{bmatrix} 120 & 50 & 30 \\ 50 & 80 & 20 \\ 30 & 20 & 10 \end{bmatrix}$;

   ii. $\begin{bmatrix} 120 & -55 & -75 \\ -55 & 55 & 33 \\ -75 & 33 & -85 \end{bmatrix}$

For both the cases, $E$ = 200 GPa, $G$ = 80 GPa and $\sigma_{yp}$ = 200 MPa

D. Final report to be submitted must include:

   i. Flow Chart of the program

   ii. Program Listing

   iii. Solution of the above-mentioned states of stress