

Homework Policy

Homework Policy

- 1) You are welcome to discuss class concepts and the homework problems with one another. However, all final answers, calculations, and explanations on the homework you turn in must be your own work.
- 2) You may not use copies of homework assignments or solutions (from previous years or the current year) or accept help from students who took the class in previous years. You may not share your graded homework with next year's class or help them with their assignments.
- 3) Late homework will be penalized by 10% of its full grade per day late. If you anticipate problems or delays they must be reported to Prof Nerurkar at no less than 24 hours before the due date / time.

SEAS Contract of Academic Integrity

I affirm that I will not plagiarize, use unauthorized materials, or give or receive illegitimate help on assignments, papers, or examinations. I will also uphold equity and honesty in the evaluation of my work and the work of others. I do so to sustain a community built around this Code of Honor.

I certify that my work on this assignment is original and in compliance with the class homework policy and the SEAS Code of Honor.

Signature_____Date _____

To my knowledge, no member of this class has violated the homework policy, breached the SEAS Code of Honor, or acted unethically with respect to this class.

Signature_____Date _____

Name (Print)_____

If you are unable to sign this coversheet, please meet with Prof. Nerurkar as soon as possible to discuss the issue.

Homework 1

DUE: 9/16/24 BY 11:59PM uploaded to Gradescope

- (1 points) Many soft tissues in the body are viscoelastic. To simplify their mechanical characterization in a lab setting, scientists will often focus on the equilibrium or 'pseudo-steady state properties', which are the properties one measures if you deform the tissue very, very slowly. Why does this minimize viscoelastic effects?
- (1 point) Skin and ligaments are both collagen-rich connective tissues, but the former is typically modeled as isotropic, while the latter is treated as anisotropic.
 - Why?
 - Why is the collagen organization of ligaments so different from that of skin?
- (3 points) Compute the following for a 3 dimensional space (i,j,k =1,2,3 each). Assume a Cartesian coordinate system defined by basis set $\{e_i\}$:
 - δ_{zz}
 - $\epsilon_{ijk}\epsilon_{kji}$
 - $\delta_{ik}a_k$ where a_k are the components of a vector **a**
- (1 points) Using indicial notation, summation convention, and the Levi-Civita symbol, prove that $\mathbf{u} \times \mathbf{v} = -\mathbf{v} \times \mathbf{u}$.
- (1 points) Given $\mathbf{u} = 3\mathbf{e}_1 + 5\mathbf{e}_2 - 7\mathbf{e}_3$ and $\mathbf{v} = 6\mathbf{e}_1 + 3\mathbf{e}_3$, find the value of scalar α such that $\mathbf{u} + \alpha\mathbf{v}$ is perpendicular to \mathbf{v} .
- (1 points) Find a unit vector in the direction of $\mathbf{u} = 3\mathbf{e}_1 + 5\mathbf{e}_2 - 7\mathbf{e}_3$
- (2 point) Assuming a Cartesian coordinate system defined by basis set $\{e_i\}$ for the matrix equation

$$\begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix} = \begin{bmatrix} F_{11} & F_{12} & F_{13} \\ F_{21} & F_{22} & F_{23} \\ F_{31} & F_{32} & F_{33} \end{bmatrix} \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix} + \begin{bmatrix} c_1 \\ c_2 \\ c_3 \end{bmatrix}$$

- Rewrite this equation in component form, employing Einstein summation convention. Indicate the free and the dummy indices.
- Rewrite this equation in tensor/vector notation