COURSE CONTENT OF <u>CIV100/APS160 MECHANICS</u> FOR 2025-26

<u>COURSE DESCRIPTION:</u>

The principles of statics are applied to the composition and resolution of forces, moments and couples. The equilibrium state of particles and rigid bodies are examined in the two-dimensional and three-dimensional space. Throughout, the free body diagram concept is emphasized and utilized. Vector algebra is used where it is most useful, and distributed loading and pressure blocks are introduced. Simple structures such as trusses, and frames and machines, are analysed from a static equilibrium standpoint. First- and second-moment of areas are explained. Shear force and bending moment diagrams for beams are discussed. The action of forces produced by fluids on structures is also covered.

<u>TEXT AND NOTES:</u>

Hibbeler, R.C. *"Engineering Mechanics: Statics"*, 15th Edition, SI Units, Pearson Education (eText and optional Mastering Engineering). Complementary Notes on additional topics (*some optional*), not covered in the textbook, will be available for download from Quercus.

<u>MATERIAL TO BE COVERED</u>
The course will consist of the following chapters in the text and complementary notes. The video lectures may not cover the material in the same sequence as in the text. Although the text places some emphasis on the use of vector mechanics operations (see overleaf), the course will rely mostly on the use of scalar operations. It is assumed that students have not covered calculus integration in other courses and integration is not required in this course.

TEXT

Chapter 1   General Principles

Chapter 2   Force Vectors

Chapter 3   Equilibrium of a Particle

Chapter 4   Force System Resultants *(In Section 4.8 omit Reduction to a Wrench; In Section 4.9 omit distributed loads other than uniform, uniformly varying, and combinations thereof)*

Chapter 5   Equilibrium of a Rigid Body. The vector mechanics operations listed on the back of this document will normally be covered as a second aspect of this chapter.

Chapter 6   Structural Analysis *(Omit Section 6.5 on Space Trusses)*

Chapter 7   Internal Forces *(Omit Section 7.4 on Cables)*

Chapter 8   Friction *(Omit this Chapter)*

Chapter 9   Centre of Gravity and Centroid. Only areas consisting of rectangles, triangles and circles will be covered, and only volumes consisting of related prismatic shapes. *(Omit Sections 9.3 and 9.4; In Section 9.5 omit fluid pressure acting on curved surfaces)*

Chapter 10   Moment of Inertia (Second Moment of Area) *(Omit Sections 10.3, 10.5, 10.6, 10.7 and 10.8)*

Chapter 11   Virtual Work *(Omit this Chapter)*

COMPLEMENTARY NOTES

Chapter 1   Axial Stress and Strain, Hooke's Law, Buckling. <u>Included:</u> Sections 1.1 and 1.2
                              (Optional: Sections 1.3, 1.4 and 1.5)

Chapter 2   Load, Pressure, and Stress Blocks. <u>Included:</u> Sections 2.1, 2.2 and 2.3

Chapter 3   Stresses Due to Bending of Beams. <u>Included:</u> Sections 3.1, 3.2 and 3.3 *(Optional: Section 3.4)*

These interesting applications of mechanics to design are presented in the video lectures, but are optional subjects and will not be covered in the tests and exams in this course:

    (i) Design of tension members using yielding as the failure criterion
    (ii) Design of beams using initial yielding due to bending moment as the failure criterion

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TOPICS IN VECTOR MECHANICS

With one important exception the course material will be taught using scalar mechanics. The exception is the use of vector operations including vector ('cross') and scalar ('dot') products for solving problems in mechanics requiring the summation of forces and of moments of forces about lines and points in the three-dimensional space. The following topics will be covered as specific material:

-   vector representation of forces and lines using either unit vectors or parenthetical notation, e.g. (p, q, r)

-   computing a unit vector in a given direction

-   scalar and vector components of a forced in the direction of a given line (dot product followed by the scalar multiplication of a unit vector)

-   moment of a force about a point (cross product)

-   moment of a force about a line passing through the point (cross product followed by a dot product)

-   moment of a force about a line expressed as a vector

-   equilibrium problems in three dimensions.

September 2025