

COURSE CONTENT OF CIV100F – MECHANICS FOR 2015/16

COURSE DESCRIPTION:

The principles of statics are applied to the composition and resolution of forces, moments, and couples. The equilibrium states of structures are examined. Throughout, the free body diagram concept is emphasized. Vector algebra is used where it is most useful and stress blocks are introduced. Shear force and bending moment diagrams are discussed along with stress-strain relationships for different materials. Stress and deformation in axially loaded members and in flexural members (beams) are also covered.

TEXT AND NOTES:

Hibbeler, R.C. (2013). "Engineering Mechanics, Statics, Thirteenth Edition in SI Units, Pearson Prentice-Hall, and the associated Study Pack. Complementary Notes, dated July 2011, on three topics in strength of materials are available for download from Blackboard.

MATERIAL TO BE COVERED

The course will consist of the following chapters in the text and complementary notes. Lecturers may choose not to cover the material in the same sequence as in the text. Although the text places considerable emphasis on the use of vector operations, CIV100F will emphasize the use of scalar operations. It is assumed that students have not covered integration in other courses and it is not required in CIV100F.

TEXT

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| 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 (It is recommended that the first part of Section 7.1 on internal actions at a specific location along a beam be included as part of this chapter.) (The vector operations listed on the back of this document will normally be covered as the second part of this chapter.) |
| Chapter 6 | Structural Analysis (Omit Sections 6.5.) |
| Chapter 7 | Internal Forces (Omit calculus in Section 7.3, and omit Section 7.4.) |
| 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 10.5, 10.6, 10.7, 10.8, and 10.9.) |
| Chapter 11 | Virtual Work (Omit this chapter.) |

COMPLEMENTARY NOTES

- Chapter 1 Axial Stress and Strain, Hooke' s Law, Buckling (Omit Section 1.3 and columns with intermediate lateral supports.)
- Chapter 2 Load, Pressure, and Stress Blocks
- Chapter 3 Stresses Due to Bending of Beams

These applications of mechanics to design will be covered:

- (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.

TOPICS IN VECTOR MECHANICS

With one important exception the course material will be taught using scalar mechanics. The one exception is the use of vector operations including dot and cross products for solving problems in mechanics requiring the moment of forces in space about lines and points. The following topics will usually be covered as a single block of 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 force 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.

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