

**COURSE FAB2010: STRUCTURAL ENGINEERING****Level:** Intermediate**Theme:** Materials and Structures**Prerequisite:** FAB1010 Fabrication Tools & Materials**Description:** Students investigate the nature of forces and structural materials, and apply their findings to design and fabrication activities.**Parameters:** Access to a fabrication work centre complete with basic hand tools.**Supporting Course:** FAB1100 Fabrication Principles**Curriculum and Assessment Standards**

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> <li>list and describe the principal characteristics of all structures</li> <li>identify strategies to improve the efficiency of a structure</li> <li>apply principles of structural design to fabrication and construction activities</li> </ul>	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> <li>a written or oral report that provides evidence that:               <ul style="list-style-type: none"> <li>all structures found in nature or in the constructed world share common elements and principles of construction</li> <li>structural elements provide both shape and support to the structure</li> <li>forces are dispersed throughout the structure</li> <li>forces must be kept in balance to keep a structure from failing</li> </ul> </li> <li>complete analysis of a given structure to show how:               <ul style="list-style-type: none"> <li>strength can be improved</li> <li>weight can be reduced</li> <li>building costs can be reduced</li> </ul> </li> <li>safe fabrication/construction of a structure or component that meets overall design requirements in relation to strength, appearance and cost.</li> </ul>	20
	<p><i>Assessment Tool</i>  <i>Presentations/Reports: Building Structures, FAB2010-1</i></p>	20
	<p><i>Standard</i>  <i>Assessment will be based on the strength to weight ratio, appearance, cost of materials and ease of construction</i>  <i>Performance rating of 2 for each applicable task</i></p>	60

**COURSE FAB2010: STRUCTURAL ENGINEERING (continued)**

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> <li>demonstrate basic competencies.</li> </ul>	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> <li>observations of individual effort and interpersonal interaction during the learning process.</li> </ul> <p><i>Assessment Tool</i>  <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>Integrated throughout</p>

Concept	Specific Outcomes	Notes
<p>Orientation</p> <ul style="list-style-type: none"> <li>Characteristics of Structure</li> <li>Types of Structures</li> <li>Structural Materials</li> <li>Structural Elements</li> </ul>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> <li>through the analysis of natural and fabricated (synthetic) forms, explain how:               <ul style="list-style-type: none"> <li>structural elements provide both shape and support</li> <li>structures are built to withstand forces of nature, applied loads and the weights of the structural components</li> <li>loads applied to a structure generate forces that must be kept in balance</li> <li>most structures are built with a margin of safety</li> </ul> </li> <li>identify from natural and synthetic structures examples of:               <ul style="list-style-type: none"> <li>frame</li> <li>shell</li> <li>non-rigid structures</li> </ul> </li> <li>identify natural and synthetic structural materials that have good:               <ul style="list-style-type: none"> <li>tensile strength</li> <li>compressive strength</li> <li>elasticity</li> </ul> </li> <li>list typical structural components that are used as:               <ul style="list-style-type: none"> <li>linear elements, such as a beam</li> <li>vertical elements, such as a column</li> <li>non-rigid elements, such as a cable</li> </ul> </li> </ul>	<p>Compare the similarities of structure found in nature to those constructed by humans.</p> <p>Explain why it is important to understand the properties of a material before it is placed in a structure.</p>

**COURSE FAB2010: STRUCTURAL ENGINEERING (continued)**

Concept	Specific Outcomes	Notes
<ul style="list-style-type: none"> <li>• Structural Elements (continued)</li> <li>• Beam and Truss Construction</li> </ul>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> <li>• explain the purpose of rigid and non-rigid materials that are used between linear and vertical elements; e.g., plywood and canvas</li> <li>• describe the advantages and disadvantages of non-rigid structures</li> <li>• show how triangulation is used to stabilize a truss and rectangular frame</li> <li>• demonstrate the effects of moving a load close to or away from the neutral axis of a beam</li> <li>• compare the connecting limits of adhesive and cohesive materials and rigid fasteners.</li> </ul>	
<p>Planning and Management</p> <ul style="list-style-type: none"> <li>• Structural Loading</li> <li>• Design Application</li> </ul>	<ul style="list-style-type: none"> <li>• describe the effects of the following forces on a simple rigid structure:               <ul style="list-style-type: none"> <li>– compression</li> <li>– tension</li> <li>– shear</li> <li>– bending</li> <li>– twisting</li> </ul> </li> <li>• show how internal forces are created to balance external loads</li> <li>• demonstrate the effects one element has on another when it fails</li> <li>• analyze an existing structure and redesign it to increase its efficiency by:               <ul style="list-style-type: none"> <li>– reducing weight yet maintaining strength</li> <li>– enhancing its durability and usefulness</li> <li>– reducing material and construction costs.</li> </ul> </li> </ul>	
<p>Implementation</p> <ul style="list-style-type: none"> <li>• Construction</li> </ul>	<ul style="list-style-type: none"> <li>• fabricate a structure or component using common materials, tools and contemporary design principles.</li> </ul>	

**COURSE FAB2010: STRUCTURAL ENGINEERING (continued)**

Concept	Specific Outcomes	Notes
<p>Assessment</p> <ul style="list-style-type: none"><li>• Quality Control and Efficiency</li><li>• Career Preparation</li></ul>	<p><i>The student should:</i></p> <ul style="list-style-type: none"><li>• analyze and test a structure or component to determine its:<ul style="list-style-type: none"><li>– strength to weight ratio</li><li>– cost efficiency</li><li>– service and construction limitations</li></ul></li><li>• prepare a record of completed activities within a portfolio.</li></ul>	<p>Simple testing devices can be constructed to determine the strength-to-weight ratio.</p>