



**UNIVERSITI TEKNOLOGI MARA**

**BCT506: MECHANICAL PROPERTIES OF BIO-COMPOSITES**

<b>Course Name (English)</b>	MECHANICAL PROPERTIES OF BIO-COMPOSITES <b>APPROVED</b>
<b>Course Code</b>	BCT506
<b>MQF Credit</b>	3
<b>Course Description</b>	This course will expose students cognitively and technically to bio-composites, specifically to their mechanical properties. Early in the course the students will engage briefly on the chemical and anatomical structures of woody plant-based material. In general, the course will discuss the basic loads experienced by bio-composites in service and their reactions to these loads. The loads discussed will be the compression, tension, shear, bending and torsion. The course will explain the different types of load models. The failure modes will also be described in relation to the materials, applied loads, and service environment. Students will be exposed to analytical solutions to some of the real world problems associated with the mechanical properties of bio-composites. Lecture sessions will employ a mixture of lectures and active learning (self and peer discussions). The outcomes shall be assessed through a variety of tools which include the paper examination, assignments and classroom engagements.
<b>Transferable Skills</b>	Explain and illustrate the standard methods of testing of bio-composite materials. Explain and illustrate (pictures & graphs) the various load models, reactions (strains and deflections), failure modes and mechanical performances of bio-composites. Identify, explain & employ the basic concepts, laws and theories in mechanics and strength of materials in the analysis of common bio-composites as a structural component. 5. Analyze, summarize and discuss solution to real world problems associated with the mechanical properties of bio-composites in relation to chemical and anatomical structure, rheological characteristics, and service environment.
<b>Teaching Methodologies</b>	Lectures, Discussion, Self-directed Learning
<b>CLO</b>	CLO1 State, write and describe various mechanical properties of bio-composite materials, for example compression, tension, shear, bending and torsion. CLO2 Explain and illustrate the standard methods of testing of bio-composite materials. CLO3 Explain and illustrate (pictures & graphs) the various load models, reactions (strains and deflections), failure modes and mechanical performances of bio-composites. CLO4 Identify, explain & employ the basic concepts, laws and theories in mechanics and strength of materials in the analysis of common bio-composites as a structural component. CLO5 Analyze, summarize and discuss solution to real world problems associated with the mechanical properties of bio-composites in relation to chemical and anatomical structure, rheological characteristics, and service environment.
<b>Pre-Requisite Courses</b>	No course recommendations
<b>Topics</b>	
<b>1. Introduction to Bio-Composite Materials</b> 1.1) General Background 1.2) Physical and Mechanical Characteristics 1.3) Chemical and Anatomical Structure	
<b>2. Concepts of Forces and Stresses</b> 2.1) Types of Forces and Vectors 2.2) External Forces 2.3) Internal Forces	

<b>3. Concepts of Deformation and Strain</b> 3.1) Forces and Deformation Diagrams 3.2) Beams 3.3) Columns
<b>4. Direct Stresses – Tension, Compression and Shear</b> 4.1) Stress and Strain Diagrams 4.2) Axially Loaded Members 4.3) Shear Stress and Strain
<b>5. Indirect Stresses – Bending and Torsion</b> 5.1) Stress and Strain Diagrams 5.2) Beams 5.3) Torsional Members
<b>6. Rheological Characteristics</b> 6.1) Viscoelasticity 6.2) Creep and Stress Relaxation 6.3) Cyclic Loading 6.4) Rheological Models
<b>7. Mode of Failures</b> 7.1) Failures Due to Static Loading 7.2) Failures Due to Hygro-stresses
<b>8. Standard Test Methods</b> 8.1) Testing Methods 8.2) – Speed of Loading, Specimen Preparation, 8.3) and Reliability of Tests 8.4) Standard Tests for Wood 8.5) Standard Tests for Composites
<b>9. Factors that Influence Strength Properties</b> 9.1) Micro-structures 9.2) Macro-structures 9.3) Natural Characteristics
<b>10. Factors That Influence Strength Properties</b> 10.1) Environmental factors 10.2) Manufacturing Processes

Assessment Breakdown	%
Continuous Assessment	70.00%
Final Assessment	30.00%

Details of Continuous Assessment	Assessment Type	Assessment Description	% of Total Mark	CLO
	Assignment	Assignment No. 1	1%	CLO3 , CLO4
	Assignment	Assignment No. 2	1%	CLO1 , CLO3 , CLO4
	Assignment	Assignment No. 3	2%	CLO3 , CLO5
	Assignment	Assignment No. 4	2%	CLO4 , CLO5
	Quiz	Quiz No. 1	1%	CLO1 , CLO2
	Quiz	Quiz No. 2	1%	CLO1 , CLO4
	Quiz	Quiz No. 3	1%	CLO3 , CLO4
	Quiz	Quiz No. 4	1%	CLO5
	Test	Test No. 1	20%	CLO1 , CLO2 , CLO3 , CLO4
	Test	Test No. 2	20%	CLO1 , CLO3 , CLO4
	Test	Test No. 3	20%	CLO3 , CLO4 , CLO5

Reading List	Recommended Text	Reference Book Resources
	<ul style="list-style-type: none"> <li>• James L. Bowyer, Rubin Shmulsky, John G. Haygreen 2007, <i>Forest Products and Wood Science</i>, Fifth Ed., All, Wiley-Blackwell [ISBN: 9780813820361]</li> <li>• Jozsef Bodig, Benjamin A. Jayne 1993, <i>Mechanics of Wood and Wood Composites</i>, All, Krieger Publishing Company USA [ISBN: 9780894647772]</li> <li>• R. C. Hibbeler 2014, <i>Mechanics of Materials</i>, 9th Ed., Pearson College Division [ISBN: 9780133254426]</li> <li>• R. C. Hibbeler 2013, <i>Engineering Mechanics</i>, 14 Ed., Prentice Hall [ISBN: 9780132915540]</li> </ul>	<ul style="list-style-type: none"> <li>• R. Bruce Hoadley 2000, <i>Understanding Wood</i>, Taunton Press USA [ISBN: 9781561583584]</li> <li>• 1980, <i>Textbook Of Wood Technology: Structure, Identification, Properties, and Uses of the Commercial Woods of the United States and Canada</i>, Mcgraw Hill [ISBN: 9780070484405]</li> </ul>
<b>Article/Paper List</b>	This Course does not have any article/paper resources	
<b>Other References</b>	This Course does not have any other resources	