

# MODULE DESCRIPTION – Mechanics of Solid

## وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	<b>Mechanics of Solid</b>		Module Delivery
Module Type	Core		<input checked="" type="checkbox"/> Theory <input type="checkbox"/> Lecture <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input type="checkbox"/> Seminar
Module Code	<b>CIER 221</b>		
ECTS Credits	5		
SWL (hr/sem)	125		
Module Level	2	Semester of Delivery	
Administering Department	CIER	College	
Module Leader	Hussein Ali Hussein	e-mail	hussein.a.hilfi@muc.edu.iq
Module Leader's Acad. Title	Assistant Lecturer	Module Leader's Qualification	Ph.D.
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date	01/06/2023	Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	CIER 210 (Mechanics of Materials II)	Semester	3
Co-requisites module	None	Semester	

## Module Aims, Learning Outcomes and Indicative Contents

### أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

<p><b>Module Objectives</b> أهداف المادة الدراسية</p>	<p>Graduation of civil engineers qualified to work in their various fields of specialization:</p> <ol style="list-style-type: none"><li>1. Providing the student with the necessary skills and mechanisms to deal with the latest developments in scientific and technical progress in their field of specialization.</li><li>2. Special care for outstanding students and enabling them to put forward their ideas.</li><li>3. Providing the student with high skill and the ability to solve problems and teamwork.</li><li>4. Instilling the spirit of diligence and perseverance and encouraging them to create and innovate.</li></ol>
<p><b>Module Learning Outcomes</b> مخرجات التعلم للمادة الدراسية</p>	<p>Module Learning Outcomes include the following:</p> <ol style="list-style-type: none"><li>1. Demonstrate an understanding of the effects of applying a torsional loading to a long straight member having circular and noncircular cross sections and how to determine both the stress and strain distribution within the member.</li><li>2. Demonstrate an understanding of the effects of applying a torsional loading to a long straight member having hollow and composite circular cross sections and how to determine both the stress and strain distribution within the member.</li><li>3. Demonstrate an understanding of complex stress states in structural members subjected to combined loadings.</li><li>4. Demonstrate an understanding of the stress transformation and establish the necessary transformation equations. Determine the maximum normal and maximum shear stress at a point and find the orientation of elements upon which they act.</li><li>5. Apply the above understanding to the designs and analysis of structural members based on strength and deformation criteria.</li><li>6. Demonstrate an understanding of the strain transformation and establish the necessary transformation equations. Determine the principal strain and the maximum in-plane shear stress at a point and find the orientation of elements upon which they act.</li><li>7. Demonstrate and discuss various methods for determining the deflection and slope at specific points on beams and shafts.</li></ol>
<p><b>Indicative Contents</b> المحتويات الإرشادية</p>	<p>Indicative content includes the following:</p> <p><b>- Torsion</b></p> <p>Torsional deformation of a circular shaft, the torsion formula, solid shaft, tubular shaft, absolute maximum torsion stress, angle of twist, constant torque and cross-sectional area, multiple torques, sign convention, statically indeterminate torque-loaded members, solid noncircular shafts, thin-walled tubes having closed cross sections, average shear stress, Equilibrium of a deformed body, stress, support reactions, internal resultant loading, average normal stress, average shear stress, allowable stress, stress in simple connections, deformation, strain, shear strain, and small strain analysis. [16 hrs]</p> <p><b>- Combined Loadings</b></p>

	<p>State of stress caused by combined loadings, internal loading, stress components, normal force, shear force, bending moment, torsional moments, superposition combined shear and bending, combined bending with axial compression and/or axial tension forces. Longitudinal stress, and circumferential stress. [8 hrs]</p> <p><b>- Stress Transformation</b></p> <p>Plane-stress transformation, general equations of Plane-stress transformation, normal and shear stress components, in-plane principal stresses, orientation of principal stress plane, maximum and minimum normal stress, maximum in-plane shear stress, orientation of maximum shear stress plane, stress element, Mohr's Circle, and absolute maximum shear stress. [16 hrs]</p> <p><b>- Strain Transformation</b></p> <p>Plane-strain transformation, general equations of Plane-stress transformation, normal and shear strains, principal strains, orientation of principal strain plane, maximum in-plane shear strain, orientation of maximum shear strain plane, average normal strain, and Mohr's Circle. [8 hrs]</p> <p><b>- Deflection of Beams</b></p> <p>The elastic curve, moment-curvature relationship, slope and displacement by the integration method, sign convention and coordinates, boundary and continuity conditions, moment function, maximum deflection, discontinuity functions, slope and displacement by the moment-area method, theorem 1, theorem 2, and M/EI diagram. [8 hrs]</p> <p><b>- Solving additional problems.</b> [8 hrs]</p>
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<b>Learning and Teaching Strategies</b> استراتيجيات التعلم والتعليم	
<b>Strategies</b>	<ul style="list-style-type: none"> <li>• Introduce students to definition of mechanics of materials.</li> <li>• Self-regulated learning (i.e., planning, monitoring and evaluating one's own learning process in the classwork / Class team work).</li> <li>• Practice testing (short question answers and exams).</li> <li>• Self-explanation (i.e., explaining to oneself how new information is related to old information or explain steps taken when solving a problem or a task).</li> </ul>

<b>Student Workload (SWL)</b> الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
<b>Structured SWL (h/sem)</b> الحمل الدراسي المنتظم للطالب خلال الفصل	63	<b>Structured SWL (h/w)</b> الحمل الدراسي المنتظم للطالب أسبوعيا	4
<b>Unstructured SWL (h/sem)</b> الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	<b>Unstructured SWL (h/w)</b> الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.4
<b>Total SWL (h/sem)</b> الحمل الدراسي الكلي للطالب خلال الفصل	<b>125</b>		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 9	LO #1, #2, #3, and #4
	Assignments	3	10% (10)	2, 7, and 12	All
	Exam	1 hr	10% (10)	6	LO #1, #2, and #3
	Report	1	10% (10)	13	All
Summative assessment	Midterm Exam	2 hr	10% (10)	10	LO #1, #2, #3, #4 and #5
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
المناهج الاسبوعي النظري	
	Material Covered
Week 1	Torsion
Week 2	Torsion
Week 3	Torsion
Week 4	Torsion
Week 5	Combined loadings
Week 6	Combined loadings
Week 7	Stress transformation
Week 8	Stress transformation
Week 9	Stress transformation
Week 10	Stress transformation
Week 11	Strain transformation
Week 12	Strain transformation
Week 13	Deflection of beams
Week 14	Deflection of beams
Week 15	Solving Additional Problems
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	1- Hearn, E. J., "Mechanics of Materials" Pergamon Press, Headington Hill Hall, Oxford OX 3 0 BW, UK, 1985.	Yes
Recommended Texts	1- Hibbeler, R.C., "Mechanics of materials", 9 <sup>th</sup> Edition, Person, Singapore, 2013.	Available online
Websites		
Others	1- Notebook prepared by the instructor of the course. 2- Collection of sheets of solved problems.	

Grading Scheme				
مخطط الدرجات				
Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
<p><b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.</p>				