27Course Specification of Strength of Materials

I. Course Identification and General Information:

1	**Course Title:**	**Strength of Materials**				
2	**Course Code & Number:**	CE108				
3	**Credit hours:**	C.H				**Credit Hours**
		Th.	**Tu.**	**Pr.**	**Tr.**	
		2	2	2		4
4	**Study level/ semester at which this course is offered:**	2nd Level/ 2nd semester				
5	**Pre –requisite (if any):**	Theory of Structure, Engineering Mechanics 1, Math 1,2				
6	**Co –requisite (if any):**	----------				
8	**Program (s) in which the course is offered:**	Civil engineering				
9	**Language of teaching the course:**	English+ Arabic				
10	**Location of teaching the course:**	Class room				
11	**Prepared By:**	Dr. Mohammad A. Algorafi				
12	**Date of Approval**					

II. Course Description:

Strength of Materials is that branch of engineering mechanics which deals with structural elements behavior under load and understands how a structural element responds to applied loads and induced stress distribution (normal, shear and combined) and demonstrates the concept of structural design. The knowledge and abilities taught in this course are an essential prerequisite for subsequent courses involving structure analysis, design of concrete and steel, and most of structure engineering courses.
This course introduces the basics of normal stresses due to normal force and bending moments and determines normal stresses in elastic bodies. Also it determines the shear

stresses in homogenous sections for different straining actions under applied static loads, combined stresses analytically and graphically, and stability of columns**.**

III. Course Intended Learning Outcomes (CILOs) of the Course		**Referenced PILOs**
a.1	Develop the principles of stress and strain for structural elements under deferent types of internal forces.	**A1**
a.2	Describe the basic principle of design techniques for structural engineering elements.	**A3**
a.3	Describe the physical and mechanical properties of construction materials	**A5**
b. 1	Justify the different internal stresses/strains for different internal forces.	**B1**
b. 2	Choose the mathematical approach to calculate the stress/strain of the structural elements under deferent types of internal forces.	**B2**
c.1	Examine experimentally the allowable stress and strain for structure materials	**C1**
c.2	Design the structure elements under deferent types of internal forces	**C2**
c.3	Apply the mathematical approach to calculate the stress/strain of the structures under deferent types of internal forces.	**C3**
d. 1	Enhance a student's ability to both verbally and in written experimental reports,	**D1**

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching Strategies	Assessment Strategies
a.1-Develop the principles of stress and strain for structure elements under deferent types of internal forces.	Lecture Multimedia Presentations Presentations Tutorial Reading	Problem set- Written exam- Written assignment
a.2- Describe the basic principle of design techniques for structural engineering elements.	Lecture Multimedia Presentations Presentations Tutorial Reading	Problem set- Written exam- Written assignment
a.3- Describe the physical and mechanical properties of construction materials	Lecture Multimedia Presentations Presentations Tutorial Lab	Problem set- Written exam- Written assignment report

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b.1- Justify the different internal stress/strain for different internal forces.	Lecture Multimedia Presentations Presentations Tutorial Reading	Problem set- Written exam- Written assignment
b.2- Choose the mathematical approach to calculate the stress/strain of the structures elements under deferent types of internal forces.	Lecture Multimedia Presentations Presentations Tutorial Reading	Problem set- Written exam- Written assignment

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C Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c.1- Examine experimentally the allowable stress and strain for structure materials	lab Lecture Tutorial Multimedia Presentations	Reports, Lab exam
C.2- Design the structure elements under deferent types of internal forces	Lecture Multimedia Presentations Presentations Tutorial Reading	Problem set- Written exam- Written assignment
c.3-Apply the mathematical approach to calculate the stress/strain of the structures under deferent types of internal forces.	Lecture Multimedia Presentations Presentations Tutorial Reading	Problem set- Written exam- Written assignment

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d.1- Enhance a student's ability to both verbally and in written reports,	Lab Lecture Multimedia Presentations	Reports, -Lab exam

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IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
1	Introduction	a1, b1	Revise the cross section properties; general internal forces.	**1**	**2**
2	Normal stress and strain	a1, a2, a3, b1, b2, c2, c3	application to the analysis of simple structures; stresses on an oblique plane under axial loading and moment, Normal stresses in elastic bodies for heterogeneous and composite symmetrical and unsymmetrical sections for eccentric axial loading.	**3**	**6**
3	Shear stress and strain	a1, a2, a3, b1, b2, c2, c3	Shear stresses due to direct and flexural shear. Determination of shear stresses due to shearing force; Transverse loading: Shear flow; shear stresses; stresses under combined loading. Determination of shear stresses on sections and bolts due to torsional moment	**3**	**6**
4	Combined stresses	a1, a2, a3, b1, b2, c2, c3	Determination of combined stresses; Transformation of plane stresses: Principal stresses; maximum shearing stress; Mohr's circle	**3**	**6**
5	Stability of columns	a1, a2, a3, b1, b2, c2, c3	Buckling of columns, Critical load, Development of column formula, Euler's formula,	**2**	**4**
6	Composite sections and Temperature effects	a1, a2, a3, b1, b2, c2, c3	Stress – strain relationship for sections comprise from different materials, Effect of Temperature variation	**2**	**4**

Number of Weeks /and Units Per Semester	14	28

B - Tutorial Aspect:

Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1	cross section properties	1	2	b2, c3
2	Normal stress	3	6	b1, b2, c2, c3
3	shear stress	3	6	b1, b2, c2, c3
4	combined stresses	3	6	b1, b2, c2, c3
5	Stability of columns	**2**	**4**	b1, b2, c2, c3
6	Composite sections and Temperature effects	**2**	**4**	b1, b2, c2, c3
Number of Weeks /and Units Per Semester		**14**	**28**	

C- Practical Aspect:

Order	Tasks/ Experiments		Number of Weeks	contact hours	Learning Outcomes
1	Testing Machines and Equipment	Universal testing machines for compression and tension and accessories, measurements tools, dial gages, strain gages	1	2	a.3, c1, d1
2	Destructive Tests on Concrete	Compression test procedure	1	2	a.3, c1, d1
3		Stress-strain curve (under Compression)	1	2	
4		Flexure test	1	2	
5	Destructive Tests on Steel bars	Tension test procedure	1	2	a.3, c1, d1
6		stress-strain curve (under tension)	1	2	
7		Bent test	1	2	
8	Nondestructive tests	Schmidt Rebound Hammer test	1	2	a.3, c1, d1
9		Ultrasonic Pulse Velocity	1	2	
10		Core drilling test	5	10	

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Number of Weeks /and Units Per Semester	14	28	

V. Teaching strategies of the course:

Lecture
Multimedia Presentations
Presentations
Tutorial
Reading
Lab

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	cross section properties	b2, c3	1	4
2	Concept of Normal stress	b1, b2, c2, c3	2,3,4,	4
3	Concept of shear stress	b1, b2, c2, c3	5,6,7,	4
4	combined stresses	b1, b2, c2, c3	8,9,10	4
5	Stability of columns	b1, b2, c2, c3	11,12	2
6	Composite sections and Temperature effects	b1, b2, c2, c3	13,14	2

VII. Lab Reports:

No	Reports	Aligned CILOs(symbols)	Week Due	Mark
1	Report 1 (Testing Machines and Equipment)	a1, a5, b1, c1, c2	2	5
2	Report 2 (Tests on Concrete)	a1, a5, b1, c1, c2	5	5
3	Report 3 (Tests on Steel bars)	a1, a5, b1, c1, c2	8	5
4	Report 4 (Nondestructive tests)	a1, a5, b1, c1, c2	10	5

VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	assignment	1 to 14	20	10	b1, c2, c3
2	Reports.	3-4-5-6-7-8-9-10-11-12	20	10	a.3, c1, d1
3	Mid-term exam.	7^{th}	40	15	a1, a2, a3, b1, c2, c3
4	Final-exam lab.	15	120	15	c1, d1
5	Final-exam.	15	120	50	a1, a2, a3, b1, b2, c2, c3
	Sum		**200**	**100%**	

IX. Learning Resources:

- Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).

1- Required Textbook(s) (maximum two).

1- R. C. Hibbeler, 2011, " Structural analysis " 8th Edition, Prentice Hall

2- Essential References.

1- Theory of Structures, Part II, Wagih Mohamed El-Dakhakni, Dar Al-Maaref
2- Chu Kia Wang & Charles G. Salmon, " Introductory Structural Analysis", Prentice Hall, USA,1984

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X. Course Policies:

1	**Class Attendance:** The students should have more than 75 % of attendance according to rules and regulations of the faculty.
2	**Tardy:** The students should respect the timing of attending the lectures. They should attend within 1 minutes from starting of the lecture.
3	**Exam Attendance/Punctuality:** The student should attend the exam on time. The punctuality should be implemented according to rules and regulations of the faculty for midterm exam and final exam.
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6	**Plagiarism:** The student will be terminated from the Faculty, if one student attends the exam on another behalf according to the policy, rules and regulations of the university.
7	**Other policies:** - All the teaching materials should be kept out the examination hall. -The mobile phone is not allowed. -There should be a respect between the student and his teacher.

Reviewed By	**Vice Dean for Academic Affairs and Post Graduate Studies** **Dr. Tarek A. Barakat** **Dr. Ahmed Alwadhaf**
	Deputy Rector for Academic Affairs Dr. Ibrahim AlMutaa **Dr. Ahmed mujahed** **Dr. Munaser Alsubri**

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Course Plan (Syllabus) of Strength of Materials

I. Information about Faculty Member Responsible for the Course:								
Name of Faculty Member	Dr. Mohammad A. Algorafi	**Office Hours**						
Location& Telephone No.		**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail		2	2	2			

II. Course Identification and General Information:						
1-	**Course Title:**	***Strength of Materials***				
2-	**Course Number & Code:**	CE108				
3-	**Credit hours:**	**C.H**				**Credit Hours**
		Th.	**Tu.**	**Pr.**	**Tr.**	
		2	2	2		4
4-	**Study level/year at which this course is offered:**	2nd Level/ 2nd semester				
5-	**Pre –requisite (if any):**	Theory of Structure				
6-	**Co –requisite (if any):**	----------				
7-	**Program (s) in which the course is offered**	Civil Engineering				
8-	**Language of teaching the course:**	English+ Arabic				
9-	**System of Study:**	Semester				
10-	**Mode of delivery:**	Lecture + practical + lab				
11-	**Location of teaching the course:**	Class room +lab				

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III. Course Description:

Strength of Materials is that branch of engineering mechanics which deals with structural elements behavior under load and understands how a structural element responds to applied loads and induced stress distribution (normal, shear and combined) and demonstrates the concept of structural design. The knowledge and abilities taught in this course are an essential prerequisite for subsequent courses involving structure analysis, design of concrete and steel, and most of structure engineering courses.
This course introduces the basics of normal stresses due to normal force and bending moments and determines normal stresses in elastic bodies. Also it determines the shear stresses in homogenous sections for different straining actions under applied static loads, combined stresses analytically and graphically, and stability of columns**.**

IV. Intended learning outcomes (ILOs) of the course:

Brief summary of the knowledge or skill the course is intended to develop:

a.1 Develop the principles of stress and strain for structural elements under deferent types of internal forces.A1
a.2 Describe the basic principle of design techniques for structural engineering elements. A3
a.3 Describe the physical and mechanical properties of construction materials A5
b.1 Justify the different internal stresses/strains for different internal forces. B1
b.2 Choose the mathematical approach to calculate the stress/strain of the structural elements under deferent types of internal forces. B2
c.1 Examine experimentally the allowable stress and strain for structure materials C1
c.2 Design the structure elements under deferent types of internal forces C2
c.3 Apply the mathematical approach to calculate the stress/strain of the structures under deferent types of internal forces. C3
d.1 Enhance a student's ability to both verbally and in written experimental reports, D1

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V. Course Content:

- **Distribution of Semester Weekly Plan of Course Topics/Items and Activities.**

A – Theoretical Aspect:

Order	Topics List	Sub Topics List	Week Due	Contact Hours
1	Introduction	Revise the cross section properties; general internal forces.	1	2
2	Normal stress and strain	application to the analysis of simple structures; stresses on an oblique plane under axial loading and moment, Normal stresses in elastic bodies for heterogeneous and composite symmetrical and unsymmetrical sections for eccentric axial loading.	2,3,4	6
3	Shear stress and strain	Shear stresses due to direct and flexural shear. Determination of shear stresses due to shearing force; Transverse loading: Shear flow; shear stresses; stresses under combined loading. Determination of shear stresses on sections and bolts due to torsional moment	5,6,7	6
4	Midterm Exam		8	2
5	Combined stresses	Determination of combined stresses; Transformation of plane stresses: Principal stresses; maximum shearing stress; Mohr's circle	9,10,11	6
6	Stability of columns	Buckling of columns, Critical load, Development of column formula, Euler's formula,	12,13	4
7	Composite sections and Temperature effects	Stress – strain relationship for sections comprise from different materials, Effect of Temperature variation	14,15	4

8	Final Exam	16	2
Number of Weeks /and Units Per Semester		**16**	**32**

B - Tutorial Aspect:

Order	Topics List	Week Due	Contact Hours
1	cross section properties	1	2
2	Normal stress	2,3,4	6
3	shear stress	5,6,7	6
4	combined stresses	8,9,10	6
5	Stability of columns	11,12	4
6	Composite sections and Temperature effects	13,14	4
Number of Weeks /and Units Per Semester		**14**	**28**

C- Practical Aspect:

Order	Topics List	Week Due	Contact Hours
1	Universal testing machines for compression and tension and accessories, measurements tools, dial gages, strain gages	1	2
2	Compression test procedure	2	2
3	Stress-strain curve (under Compression)	3	2
4	Flexure test	4	2
5	Tension test procedure	5	2
6	stress-strain curve (under tension)	6	2
7	Bent test	7	2
8	Schmidt Rebound Hammer test	8	2
9	Ultrasonic Pulse Velocity	9	2
10	Core drilling test	9,10,11,12,13,14	10

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Number of Weeks /and Units Per Semester	14	28

VI. Teaching strategies of the course:

Lecture
Multimedia Presentations
Presentations
Tutorial
Reading
Lab

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	cross section properties	b2, c3	1	4
2	Concept of Normal stress	b1, b2, c2, c3	2,3,4	4
3	Concept of shear stress	b1, b2, c2, c3	5,6,7	4
4	combined stresses	b1, b2, c2, c3	8,9,10	4
5	Stability of columns	b1, b2, c2, c3	11,12	2
6	Composite sections and Temperature effects	b1, b2, c2, c3	13,14	2

VIII. Reports:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	Report 1 (Testing Machines and Equipment)	a1, a5, b1, c1, c2	2	5
2	Report 2 (Tests on Concrete)	a1, a5, b1, c1, c2	5	5
3	Report 3 (Tests on Steel bars)	a1, a5, b1, c1, c2	8	5
4	Report 4 (Nondestructive tests)	a1, a5, b1, c1, c2	10	5

Prepared by — Head of Department: Dr. Abdulkareem Yahya Al khattabi

Quality Assurance Unit: Ass. Prof. Dr. Mohammad Algorafi

Dean of the Faculty: Prof. Dr. Mohammed AL-Bukhaiti

Academic Development Center & Quality Assurance: Ass. Prof. Dr. Huda Al-Emad

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IX. Schedule of Assessment Tasks for Students During the Semester:				
Assessment	**Type of Assessment Tasks**	**Week Due**	**Mark**	**Proportion of Final Assessment**
1	assignment	1 to 14	20	10
2	Reports.	3-4-5-6-7-8-9-10-11-12	20	10
3	Mid-term exam.	7	40	15
4	Final-exam lab.	15	120	15
5	Final-exam.	15	120	50
	Sum		**200**	**100%**

X. Learning Resources:

- Written in the following order: (Author – Year of publication – Title – Edition – Place of publication – Publisher).

1- Required Textbook(s) (maximum two).

1- R. C. Hibbeler, 2011, " Structural analysis " 8th Edition, Prentice Hall

2- Essential References.

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XI. Course Policies:	
Unless otherwise stated, the normal course administration policies and rules of the Faculty of ----- apply. For the policy, see: ----------	
1	**Class Attendance:** The students should have more than 75 % of attendance according to rules and regulations of the faculty.
2	**Tardy:** The students should respect the timing of attending the lectures. They should attend within 1 minutes from starting of the lecture.
3	**Exam Attendance/Punctuality:** The student should attend the exam on time. The punctuality should be implemented according to rules and regulations of the faculty for midterm exam and final exam.
4	**Assignments & Projects:** The assignment is given to the students after each chapter, the student has to submit all the assignments for checking on time.
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