The Hashemite University
Faculty of Engineering
Course Syllabus

Course Title:	Strength of Materials (1)	**Course Number:**	2104021230
Department:	Mechanical Engineering	**Designation:**	Compulsory
Prerequisite(s):	Statics (110401211)		
Instructor:	Eng. Ahmad Bani yaseen	**Instructor's Office:**	E3102
Instructor's e-mail:	ahmadi_ah@hu.edu.jo		
Office Hours:			

Course description: The Machine Types of loads, structures and supports, axial stress and strain, normal and bending moment diagrams, torsion, bending of beams, combined stresses, shearing stress and strain, Mohr's circle of stress and strain, thin-walled pressure vessels, deflection of simple beams, buckling of columns.

Textbook(s): Mechanics of Materials, F. P. Beer et al, Eighth edition, Mc Graw Hill.

Course Outcomes: After completing the Strength of Material course, the student will:

- Recognize the different types of loading and their effects on the mechanical systems (axial loading, transverse loading, bending moments, torsion torques).
- Know the definitions of normal stress, normal strain, shear stress, shear strain,…etc.
- Analyze the stress and strain in order to design mechanical system that can withstand a given set of loading.
- Recognize the different types of deformations and study their relations to stress and strain.
- Be able to analyze statically determinate and statically indeterminate structures under different types of loading (axial loading, torsional torque and transverse loading).
- Construct shear and bending moment diagrams for beams and analyze the resulted stresses.
- Be familiar with the stress transformations and Mohr's circle and find the principal stresses and the maximum shear stress.
- Relate the beam deflection to the internal moment and derive the elastic curve of the beam.

Class schedule: Four class sessions each week; 75 minutes each

Grading Plan:

First Exam	(25 Points)
Second Exam	(25 Points)
Quizzes	(10 Points)
Final exam	(40 Points)

Course designation according to the professional component:

Professional Component	Course Designation
General Education	-----
Basic Science and Mathematics	----
Engineering Science	√
Engineering Design	√

Course relationship to program outcomes:

	ME Program Outcomes
√	1. Apply knowledge of science, mathematics (including multivariate calculus, linear algebra, differential equations) and engineering fundamentals to mechanical engineering applications. **(a, ME1)**
	2. Design and conduct experiments, as well as analyze and present results in a professional manner. **(b)**
√	3. Design, model, analyze and realize a component, system (thermal or mechanical), or process to meet specific requirements and realistic constraints. **(c, ME2)**
	4. Communicate effectively, and function in multidisciplinary teams. **(d, g)**
√	5. Identify, formulate, and solve engineering problems. **(e)**
√	6. Understand professional and ethical issues and the responsibilities of the engineering practice. **(f)**
√	7. Recognize contemporary issues and environmental, cultural, and economical consideration of the engineering profession. **(j, h)**
	8. Identify the need for professional development and engage in life-long learning. **(i)**
	9. Use the techniques, skills, and modern engineering and computing tools necessary for engineering practice. **(k)**
√	10. Apply the basics of statistics and probability. **(ME3)**
	11. Recognize the need and engage in solving national environmental issues.

Course relationship to ABET criteria for mechanical engineering programs:

	Programs must demonstrate that graduates have:
√	A. Knowledge of chemistry and calculus-based physics with depth in at least one;
	B. The ability to apply advanced mathematics through multivariate calculus and differential equations;
√	C. Familiarity with statistics and linear algebra;
√	D. The ability to work professionally in both thermal and mechanical systems areas including the design and realization of such systems.

Prepared by: Eng. Ahmad Bani yaseen **Date:** 17/July/2022

Course Contents and Approximate timeline

Chapter	**1**	**Introduction - Concept of Stress**	
	1.1	Review of the methods of statics	
	1.2	Stresses in the members of a structure	
	1.3	Stress on an oblique plane under axial loading	**4**
	1.4	Stress under general loading conditions; components of stress	
	1.5	Design considerations	
Chapter	**2**	**Stress and strain – axial loading**	
	2.1	An introduction to stress and strain	
	2.2	Statically indeterminate problems	
	2.3	Problems involving temperature changes	
	2.4	Poisson's ratio	**7**
	2.5	Multiaxial loading: Generalized Hooke's law	
	2.7	Shearing strain	
	2.8	Deformation under axial loading- Relationship between *v*, E and G	
	2.9	Stress concentrations	
Chapter	**3**	**Torsion**	
	3.1	Circular shafts in torsion	
	3.2	Angle of twist in the elastic range	
	3.3	Statically indeterminate shafts	**4**
	3.4	Design of transmission shafts	
	3.5	Stress concentration in circular shafts	
Chapter	**4**	**Pure Bending**	
	4.1	Symmetric member in pure bending	
	4.2	Stresses and deformations in the elastic range	
	4.3	Deformations in a transverse cross-section	**4**
	4.4	Members made of composite materials	
	4.5	Stress concentrations	
	4.7	Eccentric axial loading in a plane of symmetry	
Chapter	**5**	**Analysis and design of beams for bending**	
	5.1	Shear and bending-moment diagrams	**1**
	5.2	Relations among load, shear and bending moment	
Chapter	**6**	**Shearing stresses in beams and thin-walled members**	
	6.1	Horizontal shearing stress in beams	**3**
	6.3	Longitudinal shear on a beam element of arbitrary shape	
Chapter	**7**	**Transformations of stress and strain**	
	7.1	Transformation of plane stress	
	7.2	Mohr's circle for plane stress	**5**
	7.3	Principal stresses : Maximum shearing stress	
	7.4	General state of stress	
	7.6	Stresses in thin-walled pressure vessels	
Chapter	**8**	**Principal stresses under a given loading**	**2**
	8.3	Stresses under combined loading	
Chapter	**9**	**Deflection of beams**	**1**
	9.1	Deformation under transverse loading	
Chapter	**10**	**Columns**	**1**
	10.1	Stability of Structures	