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**Civil Engineering Department**

**College of Engineering**

**Salahaddin University –Erbil**

**Mechanics of Material-I**

**Course Book**

**Second Year Stage- First Semester**

**Dr. Sirwan K. Mala**

**2022/2023**

**Mechanics of Material-I Course Book**

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| **1. Course name** | Mechanics of Material-I |
| **2. Lecturer in charge** | Dr. Sirwan K. Mala |
| **3. Department/ College** | Civil / Engineering |
| **4. Contact** | Sirwan.malla@su.edu.krd, sirwan.mala@gmail.com |
| **5. Time (in hours) per week**  | 4 |
| **6. Office hours** | 4 |
| **7. Course code** | CE203 |
| **8. Teacher's academic profile**  | B.Sc. in Civil EngineeringM.Sc. & Ph.D. structural Engineering |
| **9. Keywords:** Strength, Material, Mechanics, stress, strain, deformations, deflection, shear diagram, moment diagram |
| **10. Course overview:**  Mechanics of materials deals with the behavior of solid objects subject to [stresses](https://en.wikipedia.org/wiki/Stress_%28physics%29) and [strains](https://en.wikipedia.org/wiki/Strain_%28physics%29). The study of strength of materials often refers to various methods of calculating the stresses and strains in structural members, such as beams, columns, and shafts. The methods employed to predict the response of a structure under loading and its susceptibility to various failure modes takes into account the properties of the materials such as its [yield strength](https://en.wikipedia.org/wiki/Yield_strength), [ultimate strength](https://en.wikipedia.org/wiki/Ultimate_strength), [Young's modulus](https://en.wikipedia.org/wiki/Young%27s_modulus), and [Poisson's ratio](https://en.wikipedia.org/wiki/Poisson%27s_ratio); in addition the geometric properties, such as its length, width, thickness, boundary constraints. The students will learn a methodical representation of the basic concept of stresses and the corresponding deformations in various structural members, considering axial loading, shear, torsion, and bending forces, considering the related strain (axial strain, shear strain, and twisting) due to external loads. |
| **11. Course objective:**1. To provide the basic concepts and principles of mechanics of materials.2. To give an ability to calculate stresses and deformations of objects under external loadings.3. To give an ability to apply the knowledge of mechanics of materials on engineering applications and design problems.   |
| **12. Student's obligation****Attendance**: Students are required to attend lectures. The course consists of primarily of theory lectures and tutorial lectures. Regular attendance is necessary to maintain pace with the lectures. Late attendance to class is not allowed. Maximum allowed absence is 10% (6 hrs.).  |
| **13. Forms of teaching****Lectures,** theoretic and tutorial lectures**,** **Quizzes** are given from time to time or at the end of each chapter. **Examinations**: There will be a mid-term examinations (end of November), and final examination (January).**Homework** will be given to the students. They should do the homework, but will not be submitted for evaluation. They are to make the student ready for exams. **Team work Homework and projects** will be given to students monthly. |
| **14. Assessment scheme**The weight percentages are as follows:

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| **Exam** | **Weight** |
| Quizzes | 10 % |
| Mid-term Exam | 30 % |
| Final Exam | 60 % |

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| **15. Student learning outcome:**Students will have the ability to:1. Understand the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials. 2. Calculate the stresses and strains in axially-loaded members, circular torsion members, and members subject to flexural loadings. 3. Calculate the stresses and strains associated with thin-wall spherical and cylindrical pressure vessels. 4. Determine the stresses and strains in members subjected to combined loading and apply the theories of failure for static loading. 5. Design simple bars, beams, and circular shafts for allowable stresses and loads.  |
| **16. Course Reading List and References‌:**1. **R.C. Hibbeler `` Mechanics of Material`` Prentice Hall-Pearson, 8th Edition, 2011.**
2. F.L. Singer and A. Pytel ``Strength of Materials`` Harper International Edition, 3rd Edition, 1980.
3. F.L.Bear, E.R. Johnston , and J.T. Dewolf “ Mechanics of Materials “ McGraw Hill Higher Education, 4th Edition, 2006.
4. A.C. Ugural ``Mechanics of Materials `` McGraw Hill. Inc. 1991.
5. R.S. Khurmi`` Strength of Materials( Mechanics of solid) ``SI unit, S.Ch and company LTD., New Delhi, 2008.
6. J. Case and A.H. Chilver `` Strength of Materials and Structures`` SI Unit, Edward Arnold publisher limited, 1975.
7. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979.
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| **17. The Topics:** | **Week** |
| * Course book, Introduction, Equilibrium of a Deformable Body
* Stress, Average Normal Stress
* Average Shear Stress, Allowable Stress, design of Simple Connection
* Deformation, Strain
* Hooke’s Law, Saint-Venant’s Principle, Elastic deformation of an
* Axially Loaded Member, Principle of Superposition, Statically Indeterminate Axially loaded Member
* The Force Method of analysis for Axially Loaded Member, Thermal Stress,
* Torsional Deformation of a Circular Shaft, The Torsion Formula
* Angle of Twist, Statically Indeterminate Torque-Loaded Member, Solid Non-Circular Shaft, Thin-Wall Tubes Having Closed Cross Sections.
* Shear and Moment diagram, Graphical Method for Constructing Shear and Moment Diagram
* Bending Deformation of a Straight Member, The Flexure Formula
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| **18. Sample of Questions** |
| *Determine normal and shear stresses acting on section a-a and b-b, cross-section of member AB is square ( 50mm* x *50mm)*  |  |
| *The assembly consists of two brass rods (AB & CD) of diameter 30mm and a steel rod EF of diameter 40mm and a rigid cap G, if the supports at A, C and F are rigid, determine the normal**stress developed in each rod. Take Ebrass = 101 GPa, Esteel=193GPa* |  |
| **21. Peer review**   |