Department of Mechanical and Mechatronics Engineering

College of Engineering

University of Salahaddin

Subject: Fundamentals of Design

Course Book- 2nd year students – Semester 2

Lecturer's name: Mr. Abdulbasit A. Hamza

Academic Year: 2019 - 2020

Course Book

1. Course name	Fundamentals of Design
2. Lecturer in charge	Mr. Abdulbasit Abdulqadir Hamza
3. Department/ College	Mechanical –Mechatronics Eng. Dept. / College of Engineering
4. Contact	e-mail: abdulbasit.hamza@su.edu.krd Tel: (0750 453 50 89)
5. Time (in hours) per week	Theory: 3 hrs. for each group Tutorial:
6. Office hours	8 hrs/week
7. Course code	MME2034
8. Teacher's academic profile	MSc in Manufacturing and Materials
9. Keywords	Introduction to Design, Materials Properties, Stress Analysis, static and fatigue failure theories and Deflection of Beams.

10. Course overview:

"The Fundamental of Design" is the first course in an in-depth two course series of "Machine Design." The Fundamental of Design course combines and extends previous work in engineering mechanics and materials science to study the stimulus to failure (force, stress, geometry) versus the resistance to failure (material selection, material thermal & deformation history) in order to successfully design of machine components. This course covers fundamental machine design topics such as, force, moment and torque diagrams, and analyse resulting stresses and strains in machine elements. (Define the most critically stressed point in a machine component, and analyse strains and deflections), static and fatigue failure theories.

11. Course objective:

1. To review of the concepts on stress, strain, elastic and plastic ranges of material behaviour, stress-strain relationship, and engineering materials.
2. Stress calculations under axial loading, torsion, bending, and transverse loading.
3. Brief review of deflection analysis.
4. To understand the importance of using and interpreting Mohr's circle to determine principal stresses and maximum shear stresses.
5. To obtain a working knowledge in the use of the proper failure theories under steady and variable loadings.

12. Student's obligation

1. Regular attendance is required according to the university rules.

2. The use of mobile phone during the class is prohibited.
3. Only the students who are officially enrolled can attend the class, guests and children are not admitted.
4. Daily participation and conducting assignments are required.

13. Forms of teaching

Power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work are used. Elaborations and explanations of the details are done both verbally and on whiteboard, if needed. The power-point slides will be uploaded on the Moodle web-site of the College.

14. Assessment scheme

The final grade in this course will be determined as follows:

Midterm Examination	20 %
Course work and assignments	20 %
Final Examination	60 %
Total Marks	100%

15. Student learning outcome:

At the end of the course, students will be expected to :

- Understand the stress, strain, elastic and plastic ranges of material behavior, stress-strain relationship, and engineering materials.
- Stress calculations under axial loading, torsion, bending, and transverse loading.
- understand the importance of using and interpreting Mohr's circle to determine principal stresses and maximum shear stresses.
- Calculate the deflections in beams.
- obtain a working knowledge in the use of the proper failure theories under steady and variable loadings.

16. Course Reading List and References:

1. Shigley's Mechanical Engineering Design, Tenth Edition, By Richard G. Budynas and J. Keith Nisbett, 2015.
2. A text book of Machine Design, First multicolour Edition, By R.S. Khurmi and J.K. Gupta, 2005.
3. Fundamentals of Machine Component Design, Fifth Edition, By Robert C. Juvinall and Kurt M. Marshek, 2012.

17. The Topics: 15 Weeks: From the Feb.2019 to May 2019		Lecturer's name
Weeks	**Topics**	Mr. Abdulbasit A. Hamza
1st Week	Introduction to Mechanical Engineering Design, Standards and Codes - Economics - Safety and Product Liability	
2nd Week	Stress and Strength - Design Factor and Factor of Safety	
3rd Week	Power Transmission Case Study Specifications-	
4th Week	Materials: Material Strength and Stiffness - The Statistical Significance of Material Properties - Strength and Cold Work - Hardness - Impact Properties -Temperature Effects - Numbering Systems	
5th Week	Powder-Metallurgy Process- Hot-Working Processes - Cold-Working Processes -The Heat Treatment of Steel - Alloy Steels - Corrosion-Resistant Steels - Casting Materials - Nonferrous Metals - Plastics - Composite Materials -Materials Selection	
6th Week	Load and Stress Analysis – Equilibrium and Free Body Diagram – Mohr's Circle for Plane Stress.	
7th Week	Normal Stresses for Beams in Bending - Shear Stresses for Beams in Bending - Torsion -Stress Concentration -Stresses in Pressurized Cylinders - Stresses in Rotating Rings - Press and Shrink Fits - Temperature Effects - Curved Beams in Bending - Contact Stresses	
8th Week	Deflection and Stiffness - Spring Rates - Tension, Compression, and Torsion - Deflection Due to Bending - Beam Deflection Methods – Beam Deflections by Superposition -Beam Deflections by Singularity Functions - Strain Energy - Castigliano's Theorem -Deflection of Curved Members -	
9th Week	Compression Members General -Long Columns with Central Loading - Intermediate-Length Columns with Central Loading -Columns with Eccentric Loading - Struts or Short Compression Members - Elastic Stability -Shock and Impact **205**erature Effects - Curved Beams in Bending -Contact Stresses	

10th Week	Midterm exam
11th Week	Failures Resulting from Static Loading
12th Week	Failure of Brittle Materials Summary - Selection of Failure Criteria - Introduction to Fracture Mechanics - Important Design Equations
13th Week	Fatigue Failure Resulting from Variable Loading
14th Week	Fatigue Failure Criteria for Fluctuating Stress -Torsional Fatigue Strength under Fluctuating Stresses -Combinations of Loading Modes -Varying, Fluctuating Stresses; Cumulative Fatigue Damage - Surface Fatigue Strength
15th Week	Final exam

18. Practical Topics (If there is any)

19. Examinations:

1. Explanations:

2. True or false type of exams:

3. Problems:

20. Extra notes:

21. Peer review **پێداچوونەوەی هاوەڵ**

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