

| MM 474 Introduction to Biomechanics |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |      | DEPARTMENT of MECHANICAL ENGINEERING |                     |       |       |                |             |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|--------------------------------------|---------------------|-------|-------|----------------|-------------|
| Semester                            | Methods of Education                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |      |                                      |                     |       |       | Credits        |             |
|                                     | Lecture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Recit. | Lab. | Project / Field Study                | Homework            | Other | Total | Credit         | ECTS Credit |
| 8                                   | 42                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0      | -    | 12                                   | 14                  | 7     | 75    | 3              | 3.0         |
| Language                            | Turkish                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |      |                                      |                     |       |       |                |             |
| Compulsory / Elective               | Elective                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |      |                                      |                     |       |       |                |             |
| Prerequisites                       | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |      |                                      |                     |       |       |                |             |
| Course Contents                     | General anatomy and terminology. Structural and physical properties of bone, cartilage, muscle, tendon, nerve and tissue. Classification of biological elements: Shoulder, foot, knee and spinal column. Dynamics of musculoskeletal system. Strength of bio-materials. Stress-strain analysis.                                                                                                                                                                                                                                                                                                                                                                       |        |      |                                      |                     |       |       |                |             |
| Course Objectives                   | To give an engineering approach for the investigation of mechanical properties of living tissues; bone, muscle, cartilage, tendon, nerve, blood and similar others.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |      |                                      |                     |       |       |                |             |
| Learning Outcomes and Competences   | An ability to understand the mechanics of life and living and to design the tools and devices to improve the quality of life.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |      |                                      |                     |       |       |                |             |
| Textbook and / or Reference         | 1. Biomechanics: Mechanical Properties of Living Tissues, 2.Edition, Y.C. Fung, Springer-Verlag, 1993.<br>2. Biomechanics: Motion, Flow, Stress and Growth, Y.C. Fung, Springer-Verlag, 1990.<br>3. Anatomi, M.Sarsilmaz, Nobel Yayın Dağıtım, 2000.<br>4. Introduction to Fluid Mechanics, R.W. Fox & A.T. McDonald, John Wiley&Sons, Fourth Edition, 1994.<br>5. Advanced Strength and Applied Elasticity, A.C. Ugural & S.K. Fenster, Prentice Hall, Third Edition, 1995.<br>6. Theory and Problems of Continuum Mechanics, G.E. Mase, McGraw-Hill, 1970.<br>7. Theory of Machines and Mechanisms, J. E Shigley & J. J. Uicker, McGraw-Hill, Second Edition, 1995. |        |      |                                      |                     |       |       |                |             |
| Assessment Criteria                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |      |                                      | If any, mark as (x) |       |       | Percentage (%) |             |
|                                     | Midterm Exams                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |      |                                      | X                   |       |       | 40             |             |
|                                     | Quizzes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |      |                                      |                     |       |       |                |             |
|                                     | Homeworks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |                                      |                     |       |       |                |             |
|                                     | Projects                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |      |                                      | X                   |       |       | 20             |             |
|                                     | Term Paper                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |      |                                      |                     |       |       |                |             |
|                                     | Laboratory Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |      |                                      |                     |       |       |                |             |
|                                     | Other                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |      |                                      |                     |       |       |                |             |
| Final Exam                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |      | X                                    |                     |       | 40    |                |             |
| Instructors                         | Prof. Sefaatdin YUKSEL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |      |                                      |                     |       |       |                |             |
| Week                                | Subject                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |      |                                      |                     |       |       |                |             |
| 1                                   | Introduction to biomechanics: Biological terms, axes, planes, biological structures, implants and prostheses, etc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |      |                                      |                     |       |       |                |             |
| 2                                   | Anatomy: Human body, bone, muscle and circulation systems.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |      |                                      |                     |       |       |                |             |
| 3                                   | Elasticity: strain, stress, constitutive equations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |      |                                      |                     |       |       |                |             |
| 4                                   | Elasticity: Hooke's law and its applications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |      |                                      |                     |       |       |                |             |
| 5                                   | Viskoelasticity: creep and relaxation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |      |                                      |                     |       |       |                |             |
| 6                                   | Viscoelasticity: Kelvin and Maxwell models, generalized models.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |      |                                      |                     |       |       |                |             |
| 7                                   | Viskoelastisite: creep and relaxation functions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |        |      |                                      |                     |       |       |                |             |
| 8                                   | Fluids: Basic and viscosity.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |      |                                      |                     |       |       |                |             |
| 9                                   | Fluids: continuity and momentum equations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |      |                                      |                     |       |       |                |             |
| 10                                  | Fluids: Laminar flow.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |      |                                      |                     |       |       |                |             |
| 11                                  | Lagrangian dynamics: Equation of motion, generalized coordinates, lagrange equations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |      |                                      |                     |       |       |                |             |
| 12                                  | 3D kinematics of bodies: Motion analysis, displacement analysis, matrix transformation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |      |                                      |                     |       |       |                |             |
| 13                                  | Current topics.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |      |                                      |                     |       |       |                |             |
| 14                                  | Current topics.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |      |                                      |                     |       |       |                |             |