**Code and Name:**

**MAT5410 Technology-Assisted Geometric Design**

**Unit:**

Institute of Science, Department of Mathematics

**Details:**

* **Term:** 2023-2024 Spring
* **Status:** Elective
* **Class Level:** 1
* **Credit Hours:** 3-0-0-3
* **ECTS:** 6
* **Language:** Turkish

**Course Instructors:**

* **Course Coordinator:** ...
* **Assistant Instructor:** ...
  + **Phone:** ...
  + **Email:** ...@firat.edu.tr
  + **Social Accounts:** ...

**Weekly Schedule**

| **Monday** | **Tuesday** | **Wednesday** | **Thursday** | **Friday** | **Saturday** |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |

**Teaching Method:**  
Each weekly hour will include at least 45 minutes of face-to-face teaching.

**Location:**

* **In-person (YY):** Classroom (To be announced)
* **Remote (UE):** -

**Objective:**

To provide graduate-level students specializing in geometry with knowledge of dual number systems, dual-variable functions, spherical motions, and spatial motions, which are widely applicable in astronomy and engineering.

**Materials:**

1. G. Farin, *Curves and Surfaces for CAGD*, Academic Press, New York, 1988
2. H.H. Hacısalihoğlu, *Transformations and Geometries in High-Dimensional Spaces*, Ankara University Press
3. H.R. Müller, *Lectures on Kinematics*, Ankara University Press
4. O. Bottema, B. Roth, *Theoretical Kinematics*, Dover Publications, 1990

**Student Responsibilities:**

Students are required to attend at least 70% of the classes.

**Weekly Lesson Plan:**

| **Week** | **Topic** | **Methodology** |
| --- | --- | --- |
| 1 | Introduction to the course and key concepts | Face-to-Face |
| 2 | **Basic Concepts**: Points, vectors, affine transformations, function spaces | Face-to-Face |
| 3 | **Linear Interpolation and de Casteljau Algorithm**: Linear interpolation, Menelaus theorem, properties of Bézier curves | Face-to-Face |
| 4 | **Bézier Curves and Bernstein Form**: Bézier curves, Bernstein polynomials | Face-to-Face |
| 5 | **Polynomial Curve Construction and B-Spline Curves** | Face-to-Face |
| 6 | **Spline Curves and Differential Geometry**: Frenet frame, osculating circle | Face-to-Face |
| 7 | **Geometric Continuity**: Definitions and properties | Face-to-Face |
| 8 | **Conic Sections, Rational Bézier and B-Spline Curves** | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | **Tensor Products and Polynomial Patches**: Properties and applications | Face-to-Face |
| 11 | **Composite Surfaces and Bézier Triangles** | Face-to-Face |
| 12 | **Differential Geometry of Surfaces**: Parametric surfaces, arc length, Gaussian and mean curvature | Face-to-Face |
| 13 | **Geometric Continuity for Surfaces** | Face-to-Face |
| 14 | **Coons Patches**: Coons patches and Gordon surfaces | Face-to-Face |

**Assessment and Evaluation:**

| **Method** | **Quantity** | **Weight** |
| --- | --- | --- |
| **Midterm Exam** | 1 | 50% |
| **Quizzes** | None | - |
| **Assignments** | Pre- and post-midterm activities | - |
| **Projects** | None | - |
| **Final Exam** | 1 | 50% |

**Learning Outcomes:**

1. Learn linear interpolation and the de Casteljau algorithm.
2. Understand Bézier curves and the Bernstein form of a Bézier curve.
3. Learn polynomial curve construction, B-Spline curves, and geometric continuity.
4. Comprehend conic sections, rational Bézier and B-Spline curves, tensor products, and polynomial patches.
5. Understand composite surfaces, Bézier triangles, and the differential geometry of surfaces.

**Special Notes:**

* **UE:** Remote Education
* **YY:** Face-to-Face Education