King Fahd University of Petroleum & Minerals
Department of Mathematics
Math 583 – Syllabus
Semester 211
Dr. Rachid Ait-Haddou (aithaddou@kfupm.edu.sa)

Course Number	MATH 583
Course Title	Computer Graphics: Modeling and Processing
Course Main Objectives	. Provide a thorough overview of methods for generating free form curves and surfaces . Assessing 3D Models quality . Provide basic mathematical concepts in computer graphics and geometric modeling and processing
Course Leaning Outcomes	**By the end of this course, students will be able to:** 1- Explain the fundamentals of geometric modeling and processing 2- Apply algorithms for generating free form curves and surfaces 3- Use subdivision methods for generating surfaces 4- Analyze and describe geometric shapes related to computer graphics 5- Create meshes from point cloud
Catalog Course Description	This course introduces Central concepts of geometric modeling, basic shape representations (parametric and implicit curves and surfaces, meshes, point clouds), freeform curve and surface design in spline representation, subdivision surfaces, surface quality assessment, and geometry processing on meshes.
Pre-Requisites	Graduate Standing

TEXTBOOK:

- Farin, Gerald E*., Curves and surfaces for CAGD: a practical guide.* Morgan Kaufmann, 2002.

REFERENCES:

- Liao, Wenhe, Hao Liu, and Tao Li. *Subdivision Surface Modeling Technology*. Springer Singapore, 2017.
- Botsch, M., Kobbelt, L., Pauly, M., Alliez, P., & Lévy, B. (2010). *Polygon mesh processing*. CRC press.
- Bærentzen, J. Andreas, et al. *Guide to computational geometry processing: foundations, algorithms, and methods*. Springer Science & Business Media, 2012.

ASSESSEMENT:

- • Quizzes: 10%
- • Assignments: 30%
- • Major Exam: 30%
- • Final Exam: 30% (Comprehensive)

OFFICE HOURS: Monday and Wednesday 10:00 am-- 12:00 am (or by Appointment)

COURSE OUTLINE

1- Bezier curves
de Casteljau Algorithm, Subdivision, Blossom, degree elevation, Interactive design

2- B-spline Curves
Composite Bezier curves, B-spline construction and interpolation

3- Rational Bezier and B-spline Curves

4- Tensor Product Patches
Bilinear interpolation, de Casteljau algorithm, Blossom, Composite surfaces, B-spline surfaces. Point clipping and interactive design

5- Bezier Triangles
Bernstein polynomials, de Casteljau algorithm, Triangular blossom, Clough-Tocher and Powell-Sabin interpolants

6- Shape Assessment
Curvature plots, Curves and surfaces smoothing, Surface interrogation

7- Subdivision Curves and Surfaces
Catmull-Clark, Doo-Sabin, Loop and butterfly subdivisions

8- Geometry Processing on Meshes
Point cloud meshing, mesh simplification and parametrization