NATIONAL UNIVERSITY OF ENGINEERING

COLLEGE OF SCIENCES

COMPUTER SCIENCES PROGRAM

CC431 – GRAPHIC COMPUTING

I. GENERAL INFORMATION

CODE	: CC431 Graphic Computing
SEMESTER	: 7
CREDITS	: 4
HOURS PER WEEK	: 6 (Theory – Laboratory)
PREREQUISITES	: CC324 Computational Mathematics
CONDITION	: Mandatory

II. COURSE DESCRIPTION

Introduce a general understanding of 2D and 3D graphic systems and an in-depth experience with a topic related to the computer graphics area.

III. LEARNING UNITS

1. Introduction

Description of the course, definition and motivation to study and develop graphic software, application areas and market.

2. Graphic systems

Output devices. Technologies: CRTs, LCDs, DMD / DLP, OLED, Display Walls, Plasma, Stereo.

3. OpenGL Basic concepts

OpenGL basic concepts. Conventions. Windows system - GLUT. Coordinate systems. Camera model. Basic primitives. Interaction with the mouse and keyboard.

4. Geometric primitives

Points and vectors. Operators: Internal product, cross product and standards. Pipeline graphic: move models, move, illuminate.

5. 2D images

Textures. Procedural maps. UVW maps. Texture maps. Reflection maps. Bump map. Light map. Mip map.

6. Geometry

Homogeneous coordinates. Euclidean, affine and projective geometry.

7. User interfaces

WIMP models, console and direct manipulation. Toolkits: GLUI, FLTK, Qt.

8. Geometric transformations

2D / 3D geometric transformations. Coordinate systems. Matrix representations. Matrix composition.

9. Projections

3D scenes, GL_MODELVIEW and GL_PROJECTION. Stack of matrices. Local and global system and projections. Graphic Pipeline.

10. Curves

Continuity. Interpolation and approximation. Algorithm of Casteljau. Bezier curves.

11. Modeling

Modeling systems. Representation and specification of surfaces. Representation techniques. Representation by mesh of polygons. Modeling techniques.

12. Polygonization

Basic operations: sampling and structuring. Marching cubes algorithm. Methods of poligonization.

13. Meshes

Polygon meshes, 2 – manifold and no manifold. Adjustable mesh with/without edge. Operations in meshes. Data structures for meshes

14. Lighting

Z-buffer. Algorithm of phase elimination or Culling. Lighting. Pattern of tonalization. Lighting model. Sources of light.

IV. BIBLIOGRAPHY

- Hearn, Donald D.; Baker, M. Pauline. Computer Graphics with OpenGL. 3 edition. Pearson Education. 2003.

- Shreiner, Dave; Woo, Mason; Neider, Jackie; Davis, Tom. OpenGL Programming Guide: The Official Guide to Learning OpenGL. 6 edition. Addison-Wesley 2007.