

School of Arts, Design, and Creative Industries

SYLLABUS

TITLE:	Three-Dimensional Modeling
CODE:	IND 105
PREREQUISITE:	N/A
CREDITS:	3 credits 45 contact hours 1 term

DESCRIPTION

Introduction to the materials manufacturing and specification process using digital 3D drawing. Content includes design visualization, creation, and application of computer-generated 3D models in the manufacturing, communication, and publishing industries. Students will model their 3D designs from the original, hand-drawn idea to the use of a surfaces and solids modeling program. They will make use of Boolean operations in the construction and editing of models, display commands, details, geometric translation, rendering, and presentation.

JUSTIFICATION

As a form of visual communication of their proposals, it is necessary for students to understand, use, and work with the tools of analog and digital modeling, layout, prototyping, and operation, as instruments for the designed products.

COMPETENCES

The course develops the following competences in students:

- **Communication**
- **Research and exploration**

OBJECTIVES

After completion of the course, students will be able to:

1. Build three-dimensional drawings through reverse engineering.
2. Build and deconstruct their design proposals so they can draw and specify them by component and as a whole.

3. Develop digital technical drawings in two and three dimensions, represent materials and operation of their products.
4. Substitute, test, or modify complex surfaces in NURBS.
5. Estimate materials and their costs.
6. Become familiar with digital manufacturing processes, both additive and subtractive.

CONTENTS

- I. Introduction to 3D digital drawing:
 - A. Basic Rhino 3D commands in 2D:
 1. Creating Objects:
 - a) Line (or Polyline)
 - b) Curve
 - c) PointsOn (displays Control Points)
 - d) EditPtOn (displays Knots)
 - e) Rectangle (or Polygon)
 - f) Circle (or Arc)
 - g) TextObject: insert text as an object (note: to record vectors, select curves, not surfaces or solids)
 - h) Hatch: fill a closed curve with a pattern (for raster engraving)
- II. Measurement:
 - A. Length: report (on the command line) the total length of a line or curve.
 - B. Distance: report the distance between two points.
 - C. Area: report the area within a closed curve.
 - D. Dim: create a dimension (note: the text of the dimension does not change if the point where it was made has changed)
- III. Transforming an existing object:
 - A. Move: move an object from one point to another.
 - B. Copy: copy and move an object (CTRL-C and CTRL-V copy and paste on top of the original)
 - C. Scale: resize an object, by the scale factor or a before and after point size reference.
 - D. Scale 1D: resize lines or stretch a planar object into a single dimension.
 - E. Scale 2D: resize lines or stretch an object, maintaining its proportions.
 - F. Align: align an object with a reference (helps centralizing texts)
 - G. Mirror: copy and mirror an object around its axis.
 - H. Extend: continue a line or curve.
 - I. Rotate: rotate the object around an axis.
 - J. Array: copying and moving an object in an xyz array.
 - K. ArrayPolar: copy and move an object a certain number of times around a pivotal point.
 - L. Offset: copy an object in the same place and then rescale it, maintaining its proportions.
 - M. Orient: move, rotate, and scale an object with a single command.

- IV. Combining or separating objects:
 - A. Join/Explode: combine multiple contiguous segments into one curve/polyline, and vice versa (to be able to use the hatch or area command, etc. it must be closed).
 - B. Group/Ungroup: group/ungroup multiple objects by selecting or moving.
 - C. Divide: divide lines equally.
 - D. Split: split a line/curve at a point or intersection.
 - E. Trim: split intersecting curves and automatically delete the segment you want to cut.
- V. Navigating within a viewport:
 - A. Zoom (alias: z): grab a window in the viewport. The viewport will zoom in or out.
 - B. Zoom Selected (alias: zs): Zooms viewport to the size of the selected objects.
 - C. Zoom Extents (alias: ze): Zooms viewport will extend until all objects are visible.
 - D. Pan: slides the viewport up/down/left/right.
 - E. RotateView/RotateCamera: tumble around a view or tumble the view around.
 - F. MaxViewport: maximize the current view.
 - G. UndoView/RedoView: undo or redo the last view.
- VI. Basic commands of Rhino 3D in 3D:
 - A. Basic solids:
 1. Box -Sphere (Ellipsoid)
 2. Cone (TCone)
 3. Pyramid (TruncatedPyramid)
 4. Cylinder (Tube) (Torus)
 5. Pipe
 - B. 2D curves to 3D shapes:
 1. ExtrudeCrv: make a surface sweeping a curve using a line guide.
 2. Revolve: make a surface by rotating a curve around an axis.
 3. Loft: make a surface that connects two or more curves.
 4. Sweep: make a surface by sweeping a curve through another curve.
- VII. 3D shapes to 2D curves:
 - A. dupEdge: produce a curve on the edge of a solid.
 - B. dupBorders: produce a curve on the edge of a surface
 - C. make2d: create 2D, according to the selected view
 - D. unrollSrf: change a volume in flat components
 - E. Import/export: import and export models
- VIII. Modeling:
 - A. Precision modeling
- IX. Generating 2D and 3D technical drawings and exporting them
- X. Materials:
 - A. Editing materials and assigning
- XI. Rendering:
 - A. Render in Rhino 3D
 1. Render in color

2. Render in material
 3. Render in Keyshot
 4. Introduction to Keyshot
- XII. Materials:
- A. Editing materials and assigning
 - B. Render in material
 - C. Color
 - D. Base
 - E. Reflexes
 - F. Self-illumination
 - G. Transparency
 - H. Bumps
 - I. Procedural bumps
 - J. Brilliance
- XIII. Library
- A. Development of blocks and materials
 - B. Mapping – decal – texture unwrapping
- XIV. Lighting
- A. Methods
 1. Study of the scene to be illuminated
 2. Lighting resources, properties and lighting parameters
 3. Sombras
 4. Studio, outdoor, indoor, and artificial lights
 5. Using Dynamic Ranges: HDRI
 6. Environment
 7. Stage and background effects
 8. Channels
 9. Rendering parameters
 10. White balance adjustment
 11. Post process
- XV. Preparation for additive and subtractive manufacturing method:
- A. Additive manufacturing:
 1. Preparation of drawings for 3D printing
 2. Valid polysurface: closed solid polysurface
 3. ShowEdges (selection of Naked Edges)
 4. JoinEdge (arrangement of Naked Edges)
 - B. Subtractive manufacturing:
 1. Preparation of drawings for CNC cutter
 2. Nesting
 3. V-Carving toolpath
 4. Drill bits
 - C. Preparation of drawings for laser cutter
 1. Line value
 2. Heat intensity and power

METHODOLOGY

The following strategies from the active learning methodology are recommended:

- Project Oriented Learning -**POL**
- Research Based Learning - **RBL**
- Collaborative Learning – **CL**
- Visual and didactic resources on the Internet
- Talks, conferences, exhibitions

EVALUATION

Oral presentations	25%
Partial assignments	40%
Project	30%
Participation	<u>5%</u>
TOTAL	100%

LEARNING ASSESSMENT

The institutional assessment rubric is applied to the course's core activity.

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ELECTRONIC RESOURCES

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Rhino for Windows. (2021, July 7). McNeel Wiki. <https://wiki.mcneel.com/rhino/home>

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RECOMMENDED RESOURCES

André, J. (2018). *From Additive Manufacturing to 3D/4D Printing 3: Breakthrough Innovations: Programmable Material, 4D Printing and Bio-Printing*. John Wiley & Sons, Incorporated.

Brito, A. (2018). *Blender Quick Start Guide: 3D Modeling, Animation, and Render with Eevee in Blender 2.8*. Packt Publishing, Limited.

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solución constructiva de modelos formales en estudiantes de la licenciatura de diseño. *Congreso Internacional de Investigación Academia Journals*, 7(1), 910–915.

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SUBSCRIPTION DATABASES

<https://biblioteca.sagrado.edu/listado-de-bases-de-datos-bmmtg>

Academic Search Ultimate: This database covers almost all academic disciplines. It includes 1,396 searchable journals with cited references. Includes more than 75,000 Associated Press videos.

Advanced Technologies & Aerospace Database: It provides extensive coverage of advanced technological literature. Topics covered include aeronautics, astronautics, communications, computer and information technology, electronics, lasers, solid-state materials and devices, space science, and telecommunications

Applied Science & Technology Source Ultimate: It provides STEM students and researchers with the resources they need to succeed. It covers a wide range of topics including artificial intelligence, applied mathematics, plastics, hydroponics, computer science, chemical engineering, energy resources, and robotics, as well as the commercial and social implications of new technologies.

Computer Science Database: Database design, software development, web commerce, LAN, Wans, intranets and Internet magazine articles.

eBook Central: The most comprehensive selection of e-books for research, teaching and learning with content from leading publishers, and many titles available without restrictions.

eBook Collection (EBSCOhost): It contains full textbooks, such as reference works, scientific monographs, literature and fiction. This collection of e-books contains more than 3,460 free-access titles and a few titles for purchase.

eLibro: Digital platform that offers a collection of electronic books in Spanish (books, journals, research) from all academic disciplines. It includes work tools to promote study and research: online reading, downloads, personal shelves, copies and prints, annotations, underlines, bibliographic references, summary mode, reading aloud, translation into several languages, etc.

Engineering Database: It contains full-text engineering-related articles and a comprehensive index of the world literature on technological and engineering innovations dating back to 1966. Provides titles from around the world, including academic journals, commercial, and industry journals, magazines, technical reports, conference proceedings, government publications, and more

Fuente Académica Plus: The most comprehensive database of academic journals in Spanish and Portuguese. Hundreds of quality titles from Latin America, Portugal, and Spain cover all major subject areas. More than 600 full-text journals in Spanish and Portuguese that are not free access.

Material Sciences Database: This database offers its users the tools and content to stay well-informed of the latest research in the field, conduct comprehensive literature reviews, or develop solid basic knowledge for new researchers.

ACOMODO RAZONABLE

For detailed information on the process and required documentation you should visit the corresponding office. To ensure equal conditions, in compliance with the ADA Act (1990) and the Rehabilitation Act (1973), as amended, any student in need of reasonable accommodation or special assistance must complete the process established by the Vice Presidency for Academic Affairs.

ACADEMIC HONESTY, FRAUD, AND PLAGIARISM

Any student who fails to comply with the Honesty, Fraud, and Plagiarism Policy is exposed to the following sanctions: receive a zero in the evaluation and/or repetition of the assignment, an F(*) in the course, suspension, or expulsion as established in the document *Política de Honestidad Académica* (DAEE 205-001) effective in August 2005.

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