

# Xi'an Jiaotong University Course Syllabus

## – Concept Visualization Tools I

### 1. Basic information

Course Code: INDE400131

Credits: 2.5

Lecture Hours: 56 (24 hrs lecturing, 32 hrs practicing)

Type: Professional required course      Semester: 1-1

Prerequisite Courses: None

Bibliographies:

[1] Hughes J.F., van Dam A., McGuire M., Sklar D.F., Foley J.D., Feiner S.K., Akeley K., Computer Graphics: principles and practice (3rd ed.), Addison-Wesley Professional, 2009

### 2. Course Objectives and Targeted Competences

*(The objectives shall support students to reach the twelve requirements for graduation in Engineering Education Accreditation Criteria, or other accreditation requirements.)*

- 1) The course aims to make students achieve a mastery of the methods and techniques for creating three-dimensional digital models as a means of virtual prototyping with particular reference to industrial product concept design and its problems.
- 2) The teaching focuses mainly on how to explore, describe and represent complex shapes to be used in the concept phases of industrial product designs.
- 3) During the course, surface modelling software will be used because this type of software is the most used during the shape creation and evaluation in the design process. It allows describing complex shapes that need a continuous formal check, as usually occurs in industrial design.

*The Correlation between course objectives and graduation requirements for the Industrial Design (ID) program*

Students of ID program should meet the following graduation requirements:

- A. Master extensive theories on engineering and technology, humanities, social sciences, natural sciences, etc, demonstrate high scientific literacy, strong humanistic and artistic dispositions, and physical and mental wellbeing;
- B. Have solid theoretical knowledge on industrial design, and master the knowledge related to product and its development, design, aesthetics, engineering, technology, management, planning, teamwork, and professional ethics, etc.;
- C. Master methods and skills of industrial design and related fields, be able to apply multidisciplinary knowledge into reality, and have strong expression, creation, practical,

problem analysis and solving skills in the field of design;

D. Have good communication skills, teamwork spirit, strong sense of social responsibility, international vision, and be capable of applying interdisciplinary knowledge in pioneering work.

<b>Graduation Req.</b> <b>Course Obj.</b>	<b>A) Extensive theories &amp; strong dispositions</b>	<b>B) Theoretical knowledge on ID</b>	<b>C) Methods and skills of ID</b>	<b>D) Soft skills &amp; interdisciplinary innovation</b>
1) Creation of three-dimensional digital models	M	H	M	L
2) Ability to represent complex shapes	H	M	M	L
3) Proficiently use of surfaces modelling software	M	M	H	L

Note: A, B, C and D indicate the specific aspects of the graduation requirements. H, M and L refer to a strong, medium and weak correlation of the course objectives to the graduation requirements respectively.

### 3. Teaching Contents

	<b>Chapters</b>	<b>Knowledge Points</b>	<b>Credit Hours</b>
1	Interface for interaction in a 3D virtual space	<ol style="list-style-type: none"> <li>The interaction with a 3D digital world</li> <li>How to build a basic shape model</li> <li>Controlling and organizing geometry</li> <li>Measures and dimensions</li> </ol>	16
2	Introduction to surface modelling	<ol style="list-style-type: none"> <li>Introduction to NURBS</li> <li>From curves to surfaces</li> <li>Trimmed surfaces &amp; Circular round</li> <li>Intermediate exam nr. 1</li> </ol>	16
3	Advanced techniques for surface modelling	<ol style="list-style-type: none"> <li>Alignment and continuity</li> <li>Advanced rounding and filleting</li> <li>Customizations</li> </ol>	12
4	From virtual prototypes to physical prototypes	<ol style="list-style-type: none"> <li>From surfaces to solid and vice versa</li> <li>Rapid prototyping</li> <li>Intermediate exam nr. 2</li> </ol>	12

### 4. Teaching Plan

<b>Nr.</b>	<b>Teaching contents</b>	<b>Credit Hours</b>	<b>Teaching Methods</b>	<b>Teaching Objectives</b>	<b>Related Course Objective</b>
1.	Interface for interaction in a 3D virtual space	8	Theory & Practices	To be able to navigate a 3D space and to build a basic 3D shape either freely either with precise dimensions.	1
2.	Introduction to surface modelling	8	Theory & Practices	To be able to create free form curves based on NURBS equations; to select and to manage the different way for building surfaces from a set of curves.	1+3

3.	Advanced techniques for surface modelling	8	Theory & Practices	To understand the three main continuity levels in the adjacent surfaces transition; to be able to link different surfaces in a consistent way related with the desired continuity.	2+3
4.	From virtual prototypes to physical prototypes	8	Theory & Practices	To understand the constraints and the potentiality in moving from a surface to a solid modeler; to be able to setup a model properly for the realization of a physical prototype.	2+3

Note: The column “Related Course Objectives” can be filled in with the number of the corresponding course objective in Part 2.

## 5. Practices and Experiments

Nr.	Name	Contents	Teaching Methods	Related Course Objective
1				
2				
3				

Note: The column “Related Course Objectives” can be filled in with the number of the corresponding course objective in Part 2.

## 6. Extracurricular Learning

Nr.	Contents	Credit hours	Related Course Objective
1			
2			
3			

Note: The column “Related Course Objectives” can be filled in with the number of the corresponding course objective in Part 2.

## 7. Evaluation and Composition of Grades

This course includes multichoice test on theoretical aspects and practice tests: 20 % for ongoing assignments, 25 % for mid-term practical test, 25 % for final practical test, and 30 % for final theoretical test.

Formulated by \_\_\_\_\_

Reviewed by \_\_\_\_\_

Late Revision at YYYY-MM-DD

# 西安交通大学《概念表达技法I》课程教学大纲

## 一、课程基本信息

课程名称	概念表达技法I		
	Concept Visualization Tools I		
课程编号	INDE400131		
课程学分	2.5	总学时	56
学时分配	授课学时 24 上机学时: 32		
课程类型	<input type="checkbox"/> 公共课程 <input type="checkbox"/> 通识课程 <input type="checkbox"/> 学科门类基础课 <input type="checkbox"/> 专业大类基础课 <input checked="" type="checkbox"/> 专业核心课 <input type="checkbox"/> 专业选修课 <input type="checkbox"/> 集中实践		
开课学期	<input checked="" type="checkbox"/> 1-1 <input type="checkbox"/> 1-2 <input type="checkbox"/> 2-1 <input type="checkbox"/> 2-2 <input type="checkbox"/> 3-1 <input type="checkbox"/> 3-2 <input type="checkbox"/> 4-1 <input type="checkbox"/> 4-2 <input type="checkbox"/> 5-1 <input type="checkbox"/> 5-2		
先修课程			
教材、参考书及其他资料	<b>参考书 Bibliographies:</b> [1] Hughes J.F., van Dam A., McGuire M., Sklar D.F., Foley J.D., Feiner S.K., Akeley K., <i>Computer Graphics: principles and practice</i> (3 <sup>rd</sup> ed.), Addison-Wesley Professional, 2009		

二、课程目标及学生应达到的能力（工科专业对标工程教育认证标准中专业毕业要求的12条具体指标点，其他专业对标行业/评估标准中专业毕业要求的具体指标点）

1. 本课程旨在让学生掌握创建三维数字模型作为虚拟原型手段的方法和技术，特别是工业产品概念设计及其问题。
2. 教学主要侧重于如何探索、描述和表示用于工业产品设计概念阶段的复杂形状。
3. 要求学生学会使用曲面建模软件，描述需持续进行形式验证的复杂形状。

### 课程目标与专业毕业要求的关联关系

毕业要求：

本专业毕业生应达到以下知识、能力和素质的要求：

- A. 具备广博的工程技术、人文社科、自然科学等学科理论知识，较高的科学素养、人文情怀与艺术修养，具有健康的身心素质。
- B. 具有扎实的工业设计专业相关理论知识，掌握产品与开发、设计与美学、工程与技术、管理和规划、个人和团队、经济与法规、计师服务职责等方面的相关知识。
- C. 掌握工业设计相关领域方法与技能，深入了解并灵活运用多学科知识，具备较强的设计表达、设计创作以及动手实践能力，以及综合分析问题和解决问题的能力。
- D. 具有良好的沟通能力和团队协作精神，能够交叉融合不同学科知识进行开拓创新，并具备国际开放视野和社会责任感。

毕业要求 课程目标	A. 广博知识及高素养	B. 工业设计专业知识	C. 工业设计方法和技能	D. 软技能及交叉创新
1. 创建三维数字模型				
2. 复杂形状表达				
3. 使用曲面建模软件				

注：毕业要求中 A、B、C、D，对应毕业要求中各项具体内容；H、M、L 分别表示该课程目标对毕业要求相关项的强、中、弱程度。

### 三、教学内容简介

章节顺序	章节名称	知识点	参考学时
1	作为工业设计工具的数字模型		8
2	三维空间转换		8
3	曲面建模		8
4	整体建模与程序建模		8
5	表面质量管理		8
6	存储格式和模型交换格式		8
7	数字模型的用途		8

#### 四、教学安排详表

序号	教学内容	学时分配	教学方式	教学要求 (知识要求及能力要求)	对课程目标的支撑关系
1	作为工业设计工具的数字模型	8	理论、实践	1. 2.	
2	三维空间转换	8	理论、实践		
3	曲面建模	8	理论、实践		
4	整体建模与程序建模	8	理论、实践		
5	表面质量管理	8	理论、实践		
6	存储格式和模型交换格式	8	理论、实践		
7	数字模型的用途	8	理论、实践		

注：对课程目标的支撑关系可填写大纲中第二部分课程目标的相应序号。

#### 五、实践环节

实验编号	实验名称	实验内容	教学方法	对课程目标的支撑关系
1				
2				
3				

注：对课程目标的支撑关系可填写大纲中第二部分课程目标的相应序号

#### 六、课外学时分配

章节顺序	内容	参考学时	对课程目标的支撑关系
1			
2			
...			

注：对课程目标的支撑关系可填写大纲中第二部分课程目标的相应序号。

#### 七、考核方式及成绩构成

<本部分构成及考试方式可根据具体课程定制>

大纲制定者：\_\_\_\_\_

大纲审核者：xxx

最后修订时间：年月日

