# 西安交通大学《高等数学 II》课程教学大纲

## 一、课程基本信息

I. Basic Information

| | | | |
|---|---|---|---|
| 课程名称<br>Course Title | 高等数学 II<br>Higher Mathematics II | | |
| 课程编号<br>Course Number | MATH200131 | | |
| 课程学分<br>Credits | 4 | 总学时<br>Credit Hours | 64 |
| 学时分配<br>Assignment of Credit Hours | 理论:____ 实验:____ 上机:____ 课外:____<br>（课外学时不计入总学时）<br>Lecture:__64__ Studio:____ Practice in the IT room: Extracurricular:____<br>(Extracurricular hours do not count towards the total number of hours.) | | |
| 课程类型 | ☐公共课程 Public Course<br>☐通识课程 General Education Course<br>☐学科门类基础课<br>☐专业大类基础课<br>√专业核心课 **Specialized Core Course**<br>☐专业选修课 Specialized Elective Course<br>☐集中实践 Intensive Practice | | |
| 开课学期 | ☐1-1 √**1-2** ☐2-1 ☐2-2 ☐3-1 ☐3-2<br>☐4-1 ☐4-2 ☐5-1 ☐5-2 | | |

| | |
|---|---|
| 先修课程<br>Prerequisites | Elementary mathematics |
| 教材、参考书及其他资料<br>Materials (Textbook, Bibliography or Referencing and Supplementary Materials) | [1] J. Stewart, **Calculus**, Cengage Learning Brooks/Cole<br>[2] D.C. Lay, S.R. Lay, J.J. McDonald, **Linear Algebra and Its Applications, 5th Edition,** Pearson 2016 |

## 二、课程目标及学生应达到的能力

## II. Course Objectives and Expected Learning Outcomes

（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）

The course aims at providing the student with the basic tools of mathematical reasoning and modelling that are crucial for the education of

an architect. To that end, the course provides the principles and tools of mathematics needed to properly address the study of structural and design disciplines, architectural morphology, and the modeling of physical, technological, economic, social, and urban phenomena. The course includes elements of analytical geometry in the plane and in space, linear and vector algebra with its applications, differential and integral calculus, and mathematical modelling. Moreover, the course includes essential tools for the study of structural disciplines, technical physics, and architectural geometry, in view of the new methodologies oriented to parametric design.

After passing the exam, the student will be able to:

1. Recall and state the main definitions and theorems to solve a mathematical problem.
2. Provide and use the mathematical tools to solve mathematical problems within the field of architecture.
3. Identify and apply the mathematical reasoning tools to model realistic problems drawn from the architectural field.
4. Justify and control the use of mathematical tools for modelling and solving those realistic problems.
5. Analyze and interpret mathematical objects, moving from the algebraical register to the geometrical one (and vice versa)

6. Manipulate mathematical objects to design shapes and structures in the architectural field.

## 课程目标与专业毕业要求的关联关系

## Correlation between course objectives and graduation requirements for the program

**毕业要求：**

Graduation Requirements

Students of this major should meet the following graduation requirements in terms of knowledge, ability and calibre.

A. Possess broad theoretical knowledge of humanities and social sciences and natural sciences, strong scientific literacy, humanistic and artistic dispositions, and sound physical and mental well-being.

B. Have solid theoretical knowledge related to architecture, master the basic principles of architectural design, history and theory of architecture, architecture and behaviour, the safety of architecture, building structure, building materials and construction, control of the physical environment of buildings, urban and rural planning and landscape design, economy and regulations, systems and professional codes, responsibilities of architects and other related knowledge.

C. Have the methods and skills of architectural design and related planning design, master the process and methods of architectural design and have a

strong ability to express and practice architectural design, as well as good creative thinking and artistic creation ability and the ability to analyze problems and solve them comprehensively.

D. Have an international open vision and the ability to communicate, compete and cooperate across cultures.

| 毕业要求 / 课程目标 | A | B | C | D |
|---|---|---|---|---|
| 1 | H | L | L | M |
| 2 | H | M | H | H |
| 3 | H | H | H | H |
| 4 | H | M | M | M |
| 5 | H | M | L | H |
| 6 | H | H | H | M |

注：毕业要求中 A、B、C、D、E、F、G、…对应毕业要求中各项具体内容。课程目标与专业毕业要求的关联关系用 H/M/L 标注。

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 between the course objectives to the graduation requirements respectively.

## 三、教学内容简介

III. Description of teaching contents

| 章节顺序 | 章节名称<br>Chapter Title | 知识点<br>Teaching Points | 参考学时<br>Credit Hours |
|---|---|---|---|
| 1 | Theory of systems of linear equations: | Static equilibrium and linear systems. Existence and multiplicity of solutions. | 7% |
| 2 | Vectors in R3 | Linear combinations and linear independence. Scalar product, vector product, mixed product. Applied vectors and forces. Resultant and moment of a system of forces. | 8% |
| 3 | Vectorial Geometry in R3 | Points, straight lines and planes. Parametric and Cartesian description. Parallelism, intersections, | 15% |

| | | | |
|---|---|---|---|
| | | orthogonal projections. | |
| 4 | Functions of a real variable | Properties, limits and derivatives. | 20% |
| 5 | Vector-valued functions | Parametric description of curves and surfaces and their elementary geometrical properties. Linear transformations. | 25% |
| 6 | Mathematical Modelling | Integral calculus. Applications to optimization problems. Measure of length, area and volume. First and second order linear differential equations with constant coefficients. | 25% |

四、教学安排详表

IV. Teaching Arrangements

| **序号** | **教学内容** Teaching contents | **学时分配** Credit Hour | **教学方式** Teaching Method | **教学要求（知识要求及能力要求）** Learning Objectives (knowledge objective & ability objective ) | **对课程目标的支撑关系** Related |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| | | s | s | | to which Course Objective |
| 1 | Static equilibrium and linear systems. | 2% | Lecture and practical | **Recognize mathematical object in architectural context.** | all |
| 2 | Matrix form. REF and RREF | 5% | Lecture and practical session | Use matrix representation for solving L.S. Apply theorem for evaluating the multiplicity | All |
| 3 | Vectors properties and operation | 4% | Lecture and practical session | Manipulate vectors in the context of 3D geometry. Identify the vectors operators to compute projections, area, length. | All |
| 4 | Vectors application | 4% | Lecture and practica | Apply vectors operation in the context of physics | All |

| | | | | | |
|---|---|---|---|---|---|
| | | | l session | | |
| 5 | LS in R3 | 5% | Lecture and practical session | Recognize and describe LS solutions in terms of geometrical object | All |
| 6 | Linear geometrical objects | 5% | Lecture and practical session | Manipulate and interpret geometrical and algebraic representation | All |
| 7 | Reciprocal position | 5% | Lecture and practical session | Determine the reciprocal position between the linear geometrical objects | All |
| 8 | Introduction to function | 5% | Lecture and practical session | Recognize properties of elementary functions | All |

| | | | | | |
|---|---|---|---|---|---|
| 9 | Limits | 8% | Lecture and practical session | Recall limits definition. Apply limits theorems. Evaluate and prove limits. Apply limits to determine function properties. Interpret limit in terms of geometrical object | All |
| 10 | Derivatives | 7% | Lecture and practical session | Recall derivatives definition. Apply derivatives to compute the tangent. Interpret the meaning of first and second derivatives in terms of geometrical properties. | All |
| 11 | Function in R3 | 8% | Lecture and practical session | Recall and describe function definition and its properties in R3 | all |
| 12 | Lines and surface in R3 | 12% | Lecture and practical session | Interpret and design parametric curves in R2 and R3. Determine and interpret derivatives of parametric curve in R2 and R3 | All |

| | | | | | |
|---|---|---|---|---|---|
| 13 | Linear transformation | 5% | Lecture and practical session | Recognize and determine elementary transformation in R2. | all |
| 14 | Integrals | 10% | Lecture and practical session | Recall antiderivatives definition. Apply integral techniques to solve definite integrals. | all |
| 15 | Measure | 5% | Lecture and practical session | Apply integral to measure geometrical objects. | all |
| 16 | ODEs | 10% | Lecture and practical session | Use ODEs to model physical phenomena in the architectural context (Eiffel's Tower problem, Static Equilibrium and U-shape problem). Apply integration technique to solve 1st and 2nd | all |

| | | | | | |
|---|---|---|---|---|---|
| | | | | linear ODEs. | |

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。

The column *Related to which Course Objective* can be filled in with the number of the corresponding course objective in Part II.

五、实践环节

V. Studio/Lab

| 实验编号<br>No. | 实验名称<br>Subject Name | 实验内容<br>Contents | 教学方法<br>Teaching Methods | **对课程目标的支撑关系**<br>Related to which Course Objective |
|---|---|---|---|---|
| **1** | **n/a** | | | |
| **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

The column *Related to which Course Objective* can be filled in with the number of the corresponding course objective in Part II.

六、课外学时分配

VI. Extracurricular Practice

| 章节顺序 | 内容 Contents | 参考学时<br>Credit Hours | **对课程目标的支撑关系**<br>Related to which Course |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | | | Objective |
| 1 | n/a | | |
| 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

## VII. Evaluation and Composition of Grades

The assessment of the students is organized according to the schedule provided by the School's Academic Calendar.

The final grade is the sum of 3 marks:

1. attendance (max 20%)
2. The continuous assessment (max 30%),
3. The final assessment (max 50%).

Attendance is based on one’s actual participation to the class and homework.

The continuous assessment consists in 6 mid-term tests administered at the end of each unit. Each mid-term test is composed of closed-end and short open-end questions, and it is delivered by digital platforms.

The final assessment is based on written tests containing practical and

theoretical exercises and problems. At the professors complete discretion, the written test can be complemented by an oral examination.

The exam is considered to be passed if a grade larger than or equal to 60% is obtained.

大纲制定者：Domenico Savio Brunetto

大纲审核者：_____

最后修订时间：_____年___月___日