

COURSE DESCRIPTION

1. GENERAL

SCHOOL	MUSIC AND AUDIOVISUAL ARTS		
DEPARTMENT	AUDIO AND VISUAL ARTS		
LEVEL	Undergraduate		
COURSE CODE	THE104	SEMESTER	1 st
COURSE TITLE	Mathematics and Art		
INDEPENDENT TEACHING ACTIVITIES	WEEKLY TEACHING HOURS	ECTS	
Lecture, Tutorial	4	6	
COURSE CATEGORY	General Background		
COURSE TYPE	Compulsory		
PREREQUISITES	-		
LANGUAGE OF TEACHING and EXAMINATIONS	Greek		
THE COURSE IS OFFERED TO ERASMUS STUDENTS	YES (In English)		
URL	https://avarts.ionio.gr/en/studies/undergraduate/courses-descriptions/the104/		
ECLASS			

2. TEACHING RESULTS

Teaching Results
<p>Scope of the course is to provide to the students an overview of the traditional relation between mathematics and art. To understand the connection between the consistency of science and aesthetics and harmony.</p> <p>After the attendance of the course the student will be able to:</p> <ul style="list-style-type: none"> • spot and identify the golden ratio and symmetries to artefacts and artworks • understand fractals and their connection to artworks • understand ratios to music harmony • to draw functions and curves • understand basic algebra for computer programming
General Skills
<ul style="list-style-type: none"> • Seek, analyze and synthesize data • Autonomous work • Team work • Project design and management • Freedom of thought

3. CONTENT

This course analyses the relation between mathematics and art through the presentation of specific examples, as well as the basic theory, proving their bonds and interdependence. The course is organised in three basic units (painting, formative arts, and music), in each of which the basic concepts are presented, together with examples of celebrated works, in conjunction with the analysis of the respective mathematical concepts. In the context of the course, special emphasis is placed on the application of the aforementioned concepts through examples and drills. In parallel, special

tutorials are provided concerning reviewing basic mathematics that are needed in audiovisual technology.

1st Week

Course introduction. General description of the syllabus, course evaluation and the compulsory project. Introduction to Golden Ratio: definition – properties of the number Φ .

TUTORIAL: Basic mathematics overview (functions, coordinate system). Basic function graphics (straight lines, parabola, exponential etc.).

2nd Week

Doubling the cube – Fibonacci sequence – Pascal triangle and their relation to Golden Ratio. Golden ratio construction on a line segment and construction of a golden rectangle. Golden triangles, Fibonacci spirals, golden ratio examples – “The Vitruvian Man”.

TUTORIAL: Golden ratio calculation, proof of Φ properties, proof of geometric construction of golden ratio.

3rd Week

Symmetry: Definition – reflection symmetry, rotation symmetry, translation symmetry. Team theory (equivalence of symmetries).

TUTORIAL: Triangular functions, triangular circle. Sinus functions, wave function.

4th Week

Symmetry (cont). Shape symmetry (triangle, rectangle). Rosette symmetry.

TUTORIAL: Logarithms, logarithmic function. Circle equation.

5th Week

Symmetry of solids (tetrahedron, cube). Frieze symmetry (7 types of symmetry). Wallpaper symmetry (17 symmetries).

TUTORIAL: Symmetry exercises

6th Week

Fractals – Chaotic systems – selfsimilarity. Golden triangle, Weierstrass function, Durer pentagon, Von Koch snowflake.

TUTORIAL: Conics – ellipse, parabola, hyperbola. Spirals (logarithmic, linear)

7th Week

Fractals (cont). Sierpinski triangle, Sierpinski carpet. Julia sets, Mandelbrot sets. Fractal dimension. Fractal applications

TUTORIAL: Von Koch snowflake perimeter and area calculation

8th Week

Escher: his work. Symmetry in Escher paintings – Escher tilings

TUTORIAL: Fractal dimension calculation of basic shapes

9th Week

Escher (cont): selfsimilarity in Escher works – impossible shapes

TUTORIAL: Introduction to matrices. Definitions, properties – operations with matrices, matrix multiplication

10th Week

Introduction to Music and Math: Pythagoras and fractions, monohord, tone, semitone.

TUTORIAL: Transpose matrices, invert matrix, determinants, systems and determinants.

11th Week

Music and Math (cont): Fourier analysis - twelve-tone method (Schoenberg) - Xenakis

TUTORIAL: Examples of application of mathematical curves to art.

12th Week

General overview of the relation between art and mathematics - mathematics as inspiration to art. Examples (origami, mandala, rosetes, kaleidoscope etc.). Topology and its applications to architecture and sculpture.

TUTORIAL: Analysis Fourier exercises

13th Week

General overview of the course - previous exams demonstration

4. TEACHING AND LEARNING METHODS - EVALUATION

TEACHING METHOD	Lectures												
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES	Enhanced by multimedia content. The learning process is supported by the asynchronous e-learning platform e-class.												
TEACHING STRUCTURE	<table> <tr> <td>Activity</td> <td>Semester Workload</td> </tr> <tr> <td>Lectures</td> <td>26</td> </tr> <tr> <td>Tutoring Lectures</td> <td>26</td> </tr> <tr> <td>Literature Study and Analysis</td> <td>64</td> </tr> <tr> <td>Practice and Preparation</td> <td>34</td> </tr> <tr> <td>Course Total (ECTS: 6)</td> <td>150</td> </tr> </table>	Activity	Semester Workload	Lectures	26	Tutoring Lectures	26	Literature Study and Analysis	64	Practice and Preparation	34	Course Total (ECTS: 6)	150
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Course Total (ECTS: 6)	150												
EVALUATION OF STUDENTS	The evaluation is a result of the final written exam and a compulsory project.												

5. BIBLIOGRAPHY

Paul A. Calter. (2006). Squaring the Circle

Sasho Kalajdzievski (2008). Math and Art - An introduction to Visual Mathematics

Felipe Cucker (2013). Manifold Mirrors - The Crossing Paths of the Arts and Mathematics