

Module Outline

1. GENERAL

SCHOOL	EAP		
PROGRAMME	Study in Natural Sciences		
LEVEL OF STUDIES	Level 6 of the Hellenic and European Qualifications Framework		
MODULE CODE	FYE20	YEAR	
MODULE TITLE	Mathematics II		
INDEPENDENT TEACHING ACTIVITIES <i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits</i>		HOURS	CREDITS
Weekly workload: 17-18 hours x 32 weeks		560	20 ECTS
MODULE TYPE <i>Compulsory/Elective/ Mandatory Optional</i>	Compulsory		
MODULE DESCRIPTION <i>general background, special background, specialised, general knowledge, skills development</i>	General background		
PREREQUISITE MODULES	FYE10		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	GREEK		
IS THE MODULE OFFERED TO ERASMUS STUDENTS	NO		
MODULE WEBSITE (URL)	The Module has its own space in the digital learning environment of HOU (https://study.eap.gr/login/index.php) with controlled access (using a code) for students and Teaching Staff.		

2. LEARNING OUTCOMES

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Knowledge:

Upon successful completion of the Module, students are expected to:

- know and understand the fundamental concepts of Linear Algebra, and in particular those of Vector Spaces (linear dependence–independence, basis, dimension), as well as Inner Product Spaces (orthogonality).
- know and understand the basic concepts of Matrix Theory (with real or complex elements), Determinants, Linear Transformations, and the characteristic quantities of matrices.
- combine fundamental mathematical concepts with those of Vector Spaces and Matrix Theory.
- use and apply Matrix Theory to determine the linear independence of vectors in a vector space, to solve linear systems, to represent linear transformations, and to perform diagonalization.
- determine and describe the type of conic sections in the plane and surfaces in three-dimensional space using quadratic forms of symmetric matrices
- recognize differential equations in order to understand and study physical problems, such as those related to fluid motion, electric current flow in circuits, heat loss, and population growth and decline, etc.
- solve ordinary differential equations (ODEs) of first order (separable, homogeneous in the variables, exact or total differential, non-exact ODEs, linear ODEs, Bernoulli, Riccati, etc.).
- solve higher-order differential equations, including homogeneous linear equations (D'Alembert's method), homogeneous linear equations with constant or variable coefficients (Euler-type), and non-homogeneous linear equations with constant coefficients (method of undetermined coefficients) or variable coefficients (Lagrange's method)

- apply power series methods to the solution of second-order linear differential equations, as well as Linear Algebra methods to the solution of systems of differential equations.
- Linear Algebra and Differential Equations to the description and modelling of the behaviour of physical systems or phenomena, using mathematical terms and equations.

Skills:

Upon successful completion of the Module, students are expected to:

- identify and investigate matrix equation forms, either in algebraic or differential form;
- study different coordinate systems;
- incorporate differential operators and model physical systems using differential operators;
- justify and apply changes of variables to simplify the problem under study.

Competences:

Upon successful completion of the Module, students are expected to:

- organize and use the knowledge acquired to solve specific problems;
- understand and summarize scientific papers in the corresponding mathematical fields.
- Demonstrate the ability to retrieve, analyse, and synthesise data and information using appropriate technologies;
- adapt effectively to new situations;
- make informed decisions;
- work both independently and collaboratively;
- function efficiently within multidisciplinary and international teams and
- generate innovative research ideas.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the Module aim?

<i>Search for, analysis and synthesis of data and information, with the use of the necessary technology</i>	<i>Project planning and management</i>
<i>Adapting to new situations</i>	<i>Respect for difference and multiculturalism</i>
<i>Decision-making</i>	<i>Respect for the natural environment</i>
<i>Working independently</i>	<i>Showing social, professional and ethical responsibility and sensitivity to gender issues</i>
<i>Team work</i>	<i>Criticism and self-criticism</i>
<i>Working in an international environment</i>	<i>Production of free, creative and inductive thinking</i>
<i>Working in an interdisciplinary environment</i>	
<i>Production of new research ideas</i>	

The general skills that the students will acquire are:

Upon successful completion of the Module FYE 20, the student will be able to:

- Organize and utilize the acquired knowledge to solve specific problems
- Understand and recognize the application of Mathematics in the natural sciences.

3. SYLLABUS

Purpose of Module

Study of differential equations, linear and nonlinear and applications of linear algebra to physical problems.

Subjects covered

-Linear Algebra
-Differential Equations I

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY <i>Face-to-face, Distance learning, etc.</i>	- Distance teaching and learning with six (6) Group Counseling Meetings (GCMs) of 4-hour duration during the academic semester on weekends.
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	- 6 supportive GCMs (x 2 hours) - Personal communication and feedback (advisory role of Adjunct Faculty).																
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i>	During GCMs and teaching the following are used: - Remote meetings tools (webex, Teams), - Presentation software (PowerPoint, educational video - animations etc.), - Specialized software/databases for the subjects under study (NCBI PubMed, NCBI Blast, EndNote etc.). In addition, students use office automation tools, web browsers and e-reader for digital books. Communication with the students is supported by: - The digital platform of HOU (https://study.eap.gr/login/index.php) (course information, educational material posts, announcements, messages, examination results, user groups, discussion forums etc.). - e-mail																
TEACHING METHODS <i>The manner and methods of teaching are described in detail.</i> <i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i> <i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i>	<table border="1"> <thead> <tr> <th>Activity</th><th>Year Workload</th></tr> </thead> <tbody> <tr> <td>6 GCMs (x 4 hours)</td><td>24</td></tr> <tr> <td>6 Written Assignments (x 12 hours)</td><td>72</td></tr> <tr> <td>Individual Study time (13,5-14 hours x 32 weeks)</td><td>441</td></tr> <tr> <td>6 supportive GCMs (x 2 hours)</td><td>12</td></tr> <tr> <td>Self-evaluation activities</td><td>6</td></tr> <tr> <td>Final examination</td><td>5</td></tr> <tr> <td>Total Workload</td><td>560</td></tr> </tbody> </table>	Activity	Year Workload	6 GCMs (x 4 hours)	24	6 Written Assignments (x 12 hours)	72	Individual Study time (13,5-14 hours x 32 weeks)	441	6 supportive GCMs (x 2 hours)	12	Self-evaluation activities	6	Final examination	5	Total Workload	560
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STUDENT PERFORMANCE EVALUATION <i>Description of the evaluation procedure</i> <i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i> <i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i>	Students' evaluation – Grade assessment of a Module: • Written Assignments (WA): Contribute 30% to the final grade (provided that the student achieves a passing grade in the final exams). • Final Exams (FE): Contribute 70% (35% for Part A and 35% for Part B). • Optional Midterm Exam: An opportunity to participate after the completion of Part A of the course material. The Final Grade for the Module, on a scale of 10, is calculated as follows: $\text{Final Grade} = (\text{WA} \times 0.3) + (\text{FE} \times 0.7)$ Language of evaluation: Greek																

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Publications of the Hellenic Open University: Linear Algebra, G Kamvyssas, M. Hadjinicolaou
- Elementary Differential Equations and Boundary Value Problems, Boyce, Di prima.
- Study guide for the book Boyce W. E., and DiPrima R. C. Elementary Differential Equations and Boundary value problems, translated by Th. Grammenos, I. Karafyllis, F. Mergoupis, NTUA University Press, 2015.

■ **Related academic journals:**

- Linear Algebra and its applications, the Electronic Journal of Linear Algebra, linear Algebra, Int. Journal of Differential Equations, Differential equations and applications