



ARISTOTLE UNIVERSITY OF THESSALONIKI

ANALYSIS REPORT OF THE DISTANCE LEARNING METHODS FOR THE MANAGEMENT OF THE EDUCATIONAL PROCESS OF THE POSTGRADUATE STUDIES PROGRAM "ADVANCED FUNCTIONAL MATERIALS" OF THE SCHOOL OF PHYSICS, FACULTY OF SCIENCES, ARISTOTLE UNIVERSITY OF THESSALONIKI (in accordance with the provisions of Article 88 of Law 4957/2022 and Ministerial Decision 18137/Z1/2023, Government Gazette 1079/B/28-2-2023)

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The Postgraduate Studies Program (PSP) in Advanced Functional Materials organizes its educational process following distance learning methods. Specifically, the PSP adopts a blended learning system: 90% in-person and 10% remote. Remote components include units from certain courses, as the respective instructors are located outside Thessaloniki or Greece and may not be able to travel: 1 elective course 65%, 1 elective course 50%, 1 elective course 30%, and Enrichment Seminars 50%.

In accordance with the provisions of Article 88 of Law 4957/2022, and as specified by Ministerial Decision 18137/Z1/2023, the content of this report is structured around the following themes:

- Suitability of the subject matter for organization using distance learning methods.
- Analysis of proposed methods for organizing the educational process by educational activity of the P.M.
- Distribution of teaching hours for each educational activity of the P.M. by implementation method.
- Technical infrastructure, suitability, and adequacy of digital facilities for organizing the P.M. using distance learning methods.
- Digital skills and technological expertise of teaching staff in the use of ICT (<http://it.auth.gr>, Information and Communication Technologies).
- Digital educational material.
- Methods and tools for digital assessment of students.
- Certification.
- Meeting prerequisites for organizing the P.M. using distance learning methods.

A. Suitability of the cognitive object for its management using distance learning methods

According to Article 67, paragraph 4 of Law 4957/2022, the organization of courses and other educational activities using distance learning methods pertains to courses and educational activities that, by their nature, can be supported using distance learning methods and do not involve practical, laboratory, or clinical exercises requiring students' physical presence. For this purpose, the courses and educational activities of the Postgraduate Studies Program (P.M.) titled "Advanced Functional Materials" were determined by decision of the Department of Physics Assembly of Aristotle University, which can be conducted using distance learning methods.

The scope of the following courses:

a) Materials and Techniques in Modern Biomedicine (65%),

This course consists of three course sections:

1st Section: **(Taught by Prof. I. Margiolaki, University of Patras, remotely 32.5%)** Introduction to Structural Biology: The unit begins with an introduction discussing the purpose and significance of structural biology in the advancement of Biological Sciences. It then describes the proposed methodology, the use of results with graphical representations, and model manipulations.

2nd Section: **(Taught by Prof. E. Kontonasaki, Dentistry Department, Aristotle University of Thessaloniki, in-person 35%)** Biomaterials for Tissue Regeneration and Tissue Engineering Applications: Emphasis is placed on ceramics, polymers, composite materials, nanoparticles, implants, and scaffolds for the replacement and regeneration of hard and soft tissues.

3rd Section: **(Taught by Dr. A. Alexandrou, CNRS-France, remotely 32.5%)** Biosensors: Basic concepts for biosensors (limit of detection LOD, limit of quantification LOQ, ROC curve) will be presented, along with various methods for biomolecule-target recognition (antibodies, aptamers, enzymes) and physical and chemical methods used for detection: optical methods (absorption, fluorescence/phosphorescence, surface plasmon resonance, SERS), mechanical and electrochemical methods, as well as nanopores.

b) Thermal and Thermoelectric Properties of Materials, Nanostructures, and Nanostructured Materials (50%), **2 instructors; 1 instructor (Dr. K. Termentzidis) from CNRS-France, 1 instructor (Prof. T. Kyratsi) from the University of Cyprus (50% in-person, 50% remote).**

This postgraduate course covers the fundamental aspects of phenomena and study methods of thermal and thermoelectric properties of materials, nanostructures, and nanostructured materials. The course aims to calculate or predict thermal and thermoelectric properties either from atomistic simulations on the nanoscale or from experimental methods. Secondly, it introduces a unified framework for understanding the basic physics of heat transfer on the nanoscale and the conversion of thermal energy into electricity. Since the course is offered to both physicists and engineers, the importance of heat transfer and thermoelectric conversion in various applications will be examined, along with research trends, presenting some experimental, practical technological considerations, and fundamental limits.

c) Functional Adhesives, Ceramics, and Polymer Materials (30%) **(3 instructors: 2 from the Department of Chemical Engineering (Prof. X. Hatzistavrou, Dr. K. Simeonidis) AUTH in-person 70%, 1 (Dr. E. Pavlopoulou) from FORTH-ITE Crete remotely)**

This particular course consists of three sections:

Ceramic Materials (35% in-person, X. Hatzistavrou): Introduction to ceramic materials, synthesis methods, structural, physicochemical, and mechanical characteristics. Diffusion and sintering. Atomic bonding, lattice types, defects, and their effects on mechanical properties. Advanced ceramics and applications in energy and medicine. Processing methods. Composite ceramics and methods for improving their mechanical properties. Current research directions in advanced ceramics.

Polymers (30% remote, E. Pavlopoulou): Introduction to polymer materials: Definitions, main physicochemical characteristics, thermo-mechanical properties of polymers and their significance in their applications, structure-property relationships, polymer crystallization, polymers in our daily lives.

Solid Dispersions Systems (35% in-person, K. Simeonidis): Surface properties of solids, Gas and liquid adsorption, Adhesive systems: definitions, characteristic properties, characterization techniques, Stabilization of dispersion systems: electric double layer theory, surfactants, flocculation, Emulsions, Gels, Aerosols.

These specific cognitive objects are suitable for organizing their teaching through distance learning methods as they consist of theoretical lectures on modern materials with an emphasis on nanotechnology in which the respective instructors have extensive experience in these fields and can support the theoretical lectures in a supervisory and remote manner.

B. Analysis of the proposed methods of organizing the educational process for each educational activity of the MSc program.

Distance education is based on the physical distance between instructors and students during classes and relies on the use of various means to conduct the educational process. Distance education mainly relies on the use of technological methods that enable the monitoring of courses, communication between students, and communication between students and instructors. Distance education is divided into two categories: synchronous and asynchronous.

Contemporary distance education requires the simultaneous participation of the total number of postgraduate students and teaching staff with real-time interaction in remote teaching. The method of contemporary distance education contributes to the qualitative improvement of the communication between the educator (teaching staff) and the learner (postgraduate student), teamwork in educational groups with defined roles for participating members, discussion and resolution of queries regarding the teaching subject, better understanding of the taught material, development of educational dialogue in real-time, interaction in the shared use of digital teaching materials, and the development of collaboration in workgroups.

Asynchronous distance education differentiates not only the space but also the time during which the educational process takes place for both the educator and the postgraduate student. In this case, the material is posted online by the educator and studied by the student at a secondary time of their choosing. Asynchronous distance education may not offer the immediacy of communication and interaction between the teacher and the learner, but it allows postgraduate students to adapt the pace of their learning to their individual needs. This means they can progress in a lesson when ready, without having to wait for others. This flexibility is particularly useful for those with multiple commitments, such as work or family. Additionally, asynchronous distance education allows for global access to quality education. Postgraduate students can participate in programs from anywhere in the world, opening up new opportunities for education and international collaboration. Asynchronous distance education encourages postgraduate students to develop skills such as self-management, digital literacy, and communication. These skills are important for their professional lives as well.

Blended learning is a combination of two educational methods, the more traditional educational process that requires simultaneous physical presence of the educator and the postgraduate student, namely face-to-face education, and distance education. Moreover, it is a modern approach to education that combines the traditional teaching model with the use of technology. It offers a plethora of benefits to both educators and postgraduate students. Firstly, blended learning allows learners to access a variety of digital materials, giving them the opportunity to study and practice various skills whenever they wish. This expands the flexibility of learning and helps personalize teaching. Additionally, blended learning encourages interaction and collaboration between the educator and the learner, even if it is done online. This creates a more dynamic learning atmosphere and encourages the development of social collaboration skills.

In the MSc program "Advanced Functional Materials," the experience and good practices from distance education during the Covid period are utilized. The instructor delivers lectures in real-time based on the posted schedule via the Zoom platform. The students are present in the classroom where face-to-face classes are conducted and have the technical infrastructure for distance learning (internet-connected computers, overhead projector, rotating camera with built-in microphone and speakers). The instructor posts educational material on the elearning.auth.gr platform. This material includes slides, recorded lectures, notes, and bibliographic sources relevant to the subject matter of the course (books, scientific publications, hyperlinks, videos). Communication between students and the instructor is conducted

through teleconferences (Zoom) at times/days announced by the instructor to address questions and respond to issues related to the course. The instructor can announce clarifications/processes via eLearning and automatically inform those participating in the class. Additionally, the instructor can use the forum feature within the eLearning platform where students can address questions to the instructor regarding the course. The Q&A on elearning.auth is available at the course level, so it can be utilized by those participating in the specific educational process. The emails of the instructors of the MSc programs are available to the students for an alternative means of communication, as well as the eLearning chat embedded in the educational platform.

C. Distribution of teaching hours for each educational activity of the MSc program by implementation method

| Elective Course (2nd semester) | Total Hours | In person | Remotely |
|---|----------------|----------------|----------------|
| Materials and Techniques in Modern Biomedicine (2/3 units) * | 2x13 weeks=26 | 9 hours (35%) | 17 hours (65%) |
| Θερμικές και Θερμοηλεκτρικές Ιδιότητες Υλικών, Νανοδομών και Νανοδομημένων Υλικών (1/2 unit)* | 2x13 weeks=26 | 13 hours (50%) | 13 hours (50%) |
| Functional colloids, ceramics, and polymer materials (1/3 unit)* | 2x13 weeks =26 | 18 (hours) | 8 hours (30%) |

Distance education is conducted through the Zoom platform in the classroom that is properly equipped, with continuous technical support during the course.

**The content of the courses is described in detail in the previous section.*

D. Technical Infrastructure, Suitability, and Adequacy of Digital Facilities for Organizing the MSc Program with Distance Education Methods

The organization of distance education is supported by the Electronic Course Management System managed by the Information Technology Center (ITC) of the Aristotle University of Thessaloniki¹ in collaboration with the academic staff and technical support personnel (management coordinators) of the Department of Physics of AUTH, aiming to enhance conventional teaching through electronic organization. The service provides a plethora of electronic educational tools to enrich and strengthen the teaching process and experience for both educators and learners.

ITC serves as the central management body for all Information Technology and Education Technology facilities and services of the Aristotle University of Thessaloniki, and its staff have exceptional experience and expertise in utilizing technologies in distance education.

Specifically supported are:

- Integrated Learning Management System (LMS) called elearning.auth.gr, implemented using the open-source software Moodle, allowing the creation and hosting of virtual classrooms.
- Provision of a user-friendly environment for modern distance learning, enabling real-time interaction among participants and conducting remote lectures using tools such as Zoom, MS Teams, Google Meet, and BigBlueButton.
- Rooms equipped with suitable audiovisual equipment to host a distance learning program for postgraduate studies.
- Creation and hosting of the website for each MSc program using the service <https://websites.auth.gr/>.
- Technological support for creating multimedia material (podcasts - videocasts) synchronized with the speaker's presentation in the offered courses through the educational material production infrastructure of AUTH (<https://it.auth.gr/service/studio/>).
- Support for live streaming and recording of lessons.

The elearning platform allows for the development of courses accessible to individuals with disabilities, through which asynchronous distance education services are provided for all second-cycle study programs organized by the University. The platform enables the posting of educational material per course, which may include notes, presentations, exercises, indicative solutions, and recorded lectures, provided that the current legislation on personal data protection is adhered to. All educational material is provided exclusively for educational purposes of students and is protected by Law 2121/1993 (Government Gazette A' 25), provided that the relevant conditions are met.

The University establishes the general terms and conditions for organizing the educational process using distance education methods, the operational unit responsible for supporting the entire distance education process, and addressing issues related to ensuring and protecting the personal data of trainers and trainees.

¹ The I.T.C. constitutes the Digital Governance Unit of AUTH in article 210 of Law 4957.

The process of learning, as well as any other technical issue related to the method of distance education, is conducted using appropriate technologies. In the MSc program "Advanced Functional Materials," best practices evaluated during the Covid period are followed. These practices include real-time lectures via the Zoom platform, recording of lectures, and making them available to students through the elearning.auth.gr platform, where there is also the possibility of personal or class-level interactions (Chat Box). On the same platform, the instructor uploads slides and bibliographic sources (book links, scientific articles, and any other educational material deemed appropriate for understanding the study topics such as exercises, videos, contemporary studies, technological applications). The instructor communicates with students both during lectures and later during the study stage of the topics to be examined via email, telephone, elearning chat, or even through Zoom teleconferencing.

E. Digital skills and technological knowledge of the teaching staff in the use of Information and Communication Technologies (ICT)

Distance education, both in teaching and assessment matters, is supported by appropriate technologies. This support is provided by the technical support staff of the Department and, at a second level, by the Information Technology Center (ITC), the Special Technical Laboratory Staff of the Department of Physics, the academic staff, and the specialized personnel of the MSc program. The aim is to ensure the integrity of the educational process and the protection of the personal data of the participants as provided by the relevant legislative provisions. Additionally, specialized seminars are conducted by computer scientists with knowledge of the educational process to improve the skills of trainees in the new data. The teaching staff of the MSc program "Advanced Functional Materials" of the School of Physics of AUTH have the digital skills and technological knowledge in the use of Information and Communication Technologies, as well as extensive experience in the research methodology and teaching conducted both in person and remotely as utilized during the Covid period.

F. Digital Educational Material

The digital educational material to be used in the distance learning process should cover the teaching functions and may include:

- Digital (electronic) files with slides for each teaching unit of the course.
- Digital books, which are electronic editions of printed books that can be read on devices such as tablets, laptops, or e-readers.
- Recorded audiovisual files in which instructors explain the concepts of each teaching unit.
- Recorded audiovisual files from each teaching session or tutorial.
- Digital databases containing material from scientific journals and publications provided freely through the University library.
- Digital material suitable for supporting learning and practicing by postgraduate students (such as multiple-choice questions, exam templates, etc.).

Additionally, all available databases covering the cognitive subjects of the MSc program will be utilized.

G. Methods and Tools of Digital Student Assessment

The educational assessment of the acquired knowledge of postgraduate students can also be done using the method of distance examination. Generally, the techniques of digital student assessment taking place in the Physics Department's facilities are as follows:

1. Written examination with the following characteristics: open-ended questions or closed-ended questions (multiple-choice, matching, true/false, etc.), limited time, creation and distribution of different exams from a question bank, shuffling questions in each exam, shuffling answers to closed-ended questions, automatic grading for closed-ended questions.
2. Oral examination with the following characteristics: use of teleconferencing, individual, limited time (minutes).
3. Submission of assignments with the following characteristics: communication, submission, and evaluation of assignments, primarily used for assessing skills, deliverables, and exercises related to the respective course, without supervision, requires extensive time (days).

During the entire examination process, postgraduate students are monitored by a proctor, and before the start of the exam, an electronic identity check is conducted. Each proctor supervises a maximum of 25 examinees. During the course of the exam, the instructor is present to address questions or technical issues. This is a modern examination process that ensures the validity of the examination procedure while protecting the personal data of the participants.

In any case, combined solutions will be utilized to finalize student assessment. If there is any doubt on the part of the evaluator regarding the remote assessment or digital evaluation at the department's facilities, the evaluator may call the student for an oral examination within a reasonable period (e.g., 3 working days and necessarily within the examination period). In this case, the oral assessment takes precedence over the remote one.

Provisions are made for individuals with learning disabilities or disabilities who cannot be examined through the conventional process to be examined orally through the platform by a committee consisting of the instructor and two other faculty members dealing with the same or related cognitive subject. The above proposed methods ensure the educational process, promote meritocracy, and contribute to the qualitative enhancement of the services provided. The examination schedule (intermediate and final) is announced by the Secretariat of the MSc program "Advanced Functional Materials" in collaboration with all involved parties.

At the conclusion of their assessment process, students are informed of their grades through personalized notification via the electronic secretary system and/or through anonymous posting of results in a specific field of the integrated tele-education system or via another suitable electronic means.

Personal Data

According to the personal data protection policy of the Aristotle University of Thessaloniki (AUTH): AUTH, in general, complies with the current legal framework, including the General Data Protection Regulation (GDPR) of the European Union 2016/679 and Law 4624/2019, and adheres to the present Data Protection Policy by adopting appropriate technical and organizational measures for the collection, use, storage, disclosure, and transmission of personal data of all members of the academic community. The processing of personal data during the distance examination process is carried out in a manner that achieves the appropriate level of security against risks such as accidental or unlawful destruction, loss, alteration,

unauthorized disclosure, or access to personal data transmitted, stored, or otherwise processed. Teaching staff, invigilators, and individuals providing technical and/or administrative support (such as the platform administrator) are bound by confidentiality obligations. The selection of the electronic platform for conducting distance examinations is based on criteria of reliability and providing assurances regarding the protection of personal data.

Digital Assessment Material

The digital material to be used to support assessment methods may include:

- Creating assignments and question banks for multiple-choice questions both through the University's integrated e-learning management system and through any other platform of the Department.
- Electronically managing, submitting, and grading all weekly assignments (practical or developmental) of each postgraduate course both through the University's integrated e-learning management system. The final grading of each course of the MSc program is posted and managed through the electronic secretary service of AUTH.

H. Certification and Evaluation

Distance learning Postgraduate Programs (P.M.S.) are mandatory certified by the Hellenic Authority of Higher Education (H.A.H.E.) prior to their commencement according to paragraph 7 of article 80 of Law 4957/2022 and are periodically evaluated according to article 87 of the same law. Distance learning P.M.S. are internally evaluated within the framework of the Internal Quality Assurance System (I.Q.A.S.) according to article 215 of Law 4957/2022 to ensure their quality.

I. Meeting requirements for organizing P.M.S. using distance learning methods

Following the provisions of Law 4957/2022 and the Joint Ministerial Decision with number 18137/Z1/2023 (Government Gazette 1079/B/28-2-2023), it is certified that the Advanced Functional Materials P.M.S. of the Department of Physics of the School of Natural Sciences of Aristotle University of Thessaloniki meets all the requirements for its operation using distance learning methods. Specifically:

- 1) It has a comprehensive tele-education system. The "e-learning" platform (<https://elearning.auth.gr/>) will be utilized, which is a comprehensive system for managing electronic courses. This program is used for both distance and face-to-face teaching and is supported by the University's ITC Services in collaboration with academic and technical staff of the Department.
- 2) It has a Digital Governance Unit within the University. The ITC Services of Aristotle University of Thessaloniki are responsible for providing, maintaining, ensuring smooth operation, and continuously upgrading and adjusting the network and computing infrastructure and electronic services of the University, as well as providing user support for corresponding services (for more information about the operation of the ITC Services, see the following link: https://www.auth.gr/university_unit/it/).
- 3) The Postgraduate Studies Regulation according to paragraph 3 of article 79 of Law 4957/2022 (Government Gazette 141/A) has been approved. The Postgraduate Studies Regulations of Aristotle University of Thessaloniki were approved and published (Government Gazette 4084/B/23.06.2023).