COURSE OUTLINE

(1) GENERAL

SCHOOL	**Engineering**		
ACADEMIC UNIT	Mechanical Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	ΓΕ0104	**SEMESTER**	4th
COURSE TITLE	Partial Differential Equations		

INDEPENDENT TEACHING ACTIVITIES *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*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	5	6
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialized general knowledge, skills development*	General background
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://www.mie.uth.gr/?page_id=17831

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

This is an undergraduate course on linear partial differential equations (PDEs) and associated boundary and boundary-initial value problems. Special emphasis is placed on fundamental concepts, solution methods and applications of PDEs to problems in Mechanical Engineering.

With the successful completion of the course the students will be able to:

- Formulate the PDEs governing relevant physical phenomena such as wave propagation and heat diffusion.
- Classify PDEs and identify the appropriate solution method in each case.
- Solve linear PDEs of the mathematical physics, including the wave equation, the diffusion equation, the Laplace and the Poisson equations.
- Study the solutions of PDEs and draw useful conclusions concerning the behavior of the physical system described by the PDEs.

Γενικές Ικανότητες

Λαμβάνοντας υπόψη τις γενικές ικανότητες που πρέπει να έχει αποκτήσει ο πτυχιούχος (όπως αυτές αναγράφονται στο Παράρτημα Διπλώματος και παρατίθενται ακολούθως) σε ποια / ποιες από αυτές αποσκοπεί το μάθημα;.

Αναζήτηση, ανάλυση και σύνθεση δεδομένων και πληροφοριών, με τη χρήση και των απαραίτητων τεχνολογιών
Προσαρμογή σε νέες καταστάσεις
Λήψη αποφάσεων
Αυτόνομη εργασία
Ομαδική εργασία
Εργασία σε διεθνές περιβάλλον
Σχεδιασμός και διαχείριση έργων
Σεβασμός στη διαφορετικότητα και στην πολυπολιτισμικότητα
Σεβασμός στο φυσικό περιβάλλον
Επίδειξη κοινωνικής, επαγγελματικής και ηθικής υπευθυνότητας και ευαισθησίας σε θέματα φύλου
Άσκηση κριτικής και αυτοκριτικής
Προαγωγή της ελεύθερης, δημιουργικής και επαγωγικής σκέψης
……

Εργασία σε διεπιστημονικό περιβάλλον	*Άλλες…*
Παράγωγή νέων ερευνητικών ιδεών	*…….*

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Working independently
- Production of new research ideas
- Working in an interdisciplinary environment
- Production of free, creative and inductive thinking

(3) **SYLLABUS**

Sturm-Liouville Theory. Expansions in series of eigen-functions. Fourier series. Introduction to Scientific Computing with Mathematica. Classification of PDEs, Characteristic Curves – the Method of Characteristics. Elliptic Equations (Laplace, Poisson), the Methods of Separation of Variables and Finite Fourier Transform. Dirichlet & Neumann Problems. Applications to various coordinate systems. Solving Parabolic Equations (Heat Transfer) with the Method of Separation of Variables. Solving Hyperbolic Equations (Wave Equation) with the Method of Separation of Variables. Integral Fourier Transform. Heat Transfer and Wave Propagation in Infinite and Semi-Infinite Space. The Green's Function Method.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY ***Face-to-face, Distance learning, etc.***	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Supporting material is made available through the UTH e-Class platform
TEACHING METHODS *The manner and methods of teaching are described in detail.* *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.* *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*	*Activity* / *Semester workload* Lectures: 70 Homeworks: 35 Study and analysis of bibliography: 45 Course total (25 hours per credit unit): **150**
STUDENT PERFORMANCE EVALUATION ***Description of the evaluation procedure*** *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* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	*Language of evaluation*: Greek *Methods of evaluation*: A written midterm (30%) and a written final (70%) exam. Each exam consists of a number of problems to be solved by the students within 3 hours in the classroom.

(5) **ATTACHED BIBLIOGRAPHY**

- Suggested bibliography:

- Σ. Τραχανάς, "Μερικές Διαφορικές Εξισώσεις", Πανεπιστημιακές Εκδόσεις Κρήτης, 2013.
- Μυλωνάς, Ν. & Σχοινάς, Χ., Διαφορικές Εξισώσεις, Μετασχηματισμοί και Μιγαδικές Συναρτήσεις, Εκδόσεις Τζιόλα, 2015.
- Σταυρακάκης, Ν., Διαφορικές Εξισώσεις: Συνήθεις και Μερικές, Εκδόσεις Σταυρακάκης, 2015.
- Haberman Richard (2004). *Applied Partial Differential Equations, With Fourier Series and Boundary Value Problems* (Fourth ed.). NJ: Pearson/PrenticeHall.
- Strauss W.A. (2008). *Partial Differential Equations, An Introduction*. Hoboken, NJ: Wiley.
- Pinchover Y. and Rubistein J. (2005). *An Introduction to Differential Equations*. Cambridge: Cambridge University Press.

- Related academic journals:

- Journal of Engineering Mathematics
- SIAM Journal on Applied Mathematics