

## Bio-inspired Engineering

1. GENERAL			
<b>SCHOOL</b>	Faculty of Sciences in collaboration with Faculty of Engineering, Aristotle University of Thessaloniki		
<b>DEPARTMENT</b>	Materials Science and Engineering		
<b>LEVEL OF STUDIES</b>	ISCED level 7 (5-year Integrated Master's programme) ISCED level 6 (4-year BSc programme)		
<b>COURSE CODE</b>	<b>MSEN 831</b>	<b>SEMESTER</b>	8 <sup>th</sup> Semester
<b>COURSE TITLE</b>	<b>Bio-inspired Engineering</b>		
<b>TEACHING ACTIVITIES</b>	Lectures, tutorials/problem sessions, laboratory/computer exercises (where applicable), case studies and guided self-study.	<b>TEACHING HOURS PER WEEK</b>	<b>ECTS CREDITS</b>
		4	6
<b>COURSE TYPE</b>	Background / General Knowledge		
<b>PREREQUISITES</b>	No prerequisites		
<b>TEACHING AND EXAMINATION METHODS</b>	English		
<b>COURSE OFFERED TO ERASMUS STUDENTS</b>	No		
<b>COURSE URL</b>	<a href="https://elearning.auth.gr/course/view.php?id=xxxxx">https://elearning.auth.gr/course/view.php?id=xxxxx</a>		

2. LEARNING OUTCOMES	
<b>Learning Outcomes</b>	<p>On successful completion of the module, you will be able to:</p> <ul style="list-style-type: none"> <li>• Look at nature, and the balance between nature and technology, in a different (more advanced) way.</li> <li>• Understand the fundamentals and opportunities of the nature-inspired methodology.</li> <li>• Apply fundamental principles, borrowed from natural systems, to innovate product design and solve engineering problems.</li> <li>• Recognize situations where a nature-inspired methodology might bring up a new, more performing solution.</li> <li>• Solve engineering problems by employing the nature-inspired methodology.</li> </ul>
<b>General Skills</b>	<ul style="list-style-type: none"> <li>• Problem solving with quantitative reasoning</li> <li>• Teamwork</li> <li>• Information literacy</li> <li>• Technical reporting and oral communication</li> </ul>

### 3. COURSE CONTENT

Nature-inspired methodology is introduced as a powerful approach to guide the design of new processes for applications ranging from energy and energy efficiency to chemical production and therapeutics, etc.

The module will illustrate and empower the students to apply fundamental engineering principles, underpinning desirable properties observed in nature, to achieve higher performance (efficiency, scalability, robustness, etc.) and come up with innovative approaches in interdisciplinary teams to solve challenging problems by taking guidance from natural systems that are ideally structured to achieve this high performance.

### 4. LEARNING & TEACHING METHODS – EVALUATION

<b>Teaching method</b>	Face-to-face.																	
<b>Use of ICT</b>	ICT will be used in teaching the course, and in communication with students: <ul style="list-style-type: none"> <li>teaching of the course with modern distance learning (ZOOM) and asynchronous education tools via elearning platform of AUTH,</li> <li>communication with students via email, ZOOM, and elearning platform of AUTH.</li> </ul>																	
<b>Teaching organization</b>	The supervised and unsupervised workload per activity is indicated below (total workload complies with ECTS standards). <table border="1" data-bbox="523 1160 1200 1554"> <thead> <tr> <th>Activity</th> <th>Workload/semester (hours)</th> </tr> </thead> <tbody> <tr> <td>Lectures</td> <td>30</td> </tr> <tr> <td>Tutorials / problem sessions</td> <td>20</td> </tr> <tr> <td>Bibliographic Research and analysis</td> <td>20</td> </tr> <tr> <td>Independent project work</td> <td>60</td> </tr> <tr> <td>Exam preparation / revision</td> <td>16</td> </tr> <tr> <td>Assessment</td> <td>4</td> </tr> <tr> <td><b>Total</b></td> <td><b>150</b></td> </tr> </tbody> </table>		Activity	Workload/semester (hours)	Lectures	30	Tutorials / problem sessions	20	Bibliographic Research and analysis	20	Independent project work	60	Exam preparation / revision	16	Assessment	4	<b>Total</b>	<b>150</b>
Activity	Workload/semester (hours)																	
Lectures	30																	
Tutorials / problem sessions	20																	
Bibliographic Research and analysis	20																	
Independent project work	60																	
Exam preparation / revision	16																	
Assessment	4																	
<b>Total</b>	<b>150</b>																	
<b>Student evaluation</b>	<b>Assessment language</b> English <b>Assessment methods</b> <b>Formative assessment</b> is designed for students in the format of quizzes, project discussion sessions, and critical reading with feedback. Project discussion sessions will be provided to assess the progress of the team-based project. Students will be asked to read bio-inspired related scientific reports and provide comments. The comments from students will be assessed to help their understanding of the papers. <b>Summative assessment</b> , which will contribute to the final mark, will be based on <ul style="list-style-type: none"> <li>Student comments on critical scientific papers on nature-inspired methodology.</li> </ul>																	

	<ul style="list-style-type: none"> <li>- Individual coursework on key concepts of nature-inspired methodology.</li> <li>- Group-based milestone presentation on the team-based project.</li> <li>- Group-based project report on the team-based project.</li> <li>•</li> </ul>
--	--

## 5. SUGGESTED BIBLIOGRAPHY

### Course Bibliography

B. Mandelbrot, *The fractal geometry of nature*, W.H. Freeman and Co., 1983; N. Lane, *Life Ascending: The Ten Great Inventions of Evolution*, W.W. Norton & Co., 2010; S.A. Kauffman, *The Origins of Order: Self-Organization and Selection in Evolution*, Oxford University Press, 1993; R. Buckminster Fuller and D. López-Pérez, *R. Buckminster Fuller: Pattern-Thinking*, Lars Müller Publishers, 2019; D.G. Nicholls, *Bioenergetics*, Academic Press, 2013; G.M. Whitesides and B. Grzybowski, *Self-Assembly at All Scales*, *Science*, 2002, 295, pp. 2418-2421; M.-O. Coppens, *Nature-Inspired Chemical Engineering for Process Intensification*, *Annu. Rev. Chem. Biomol. Eng.* 2021, 12, pp. 187-215.

### Additional bibliography for study

Professors' notes