

SYLLABUS ¹

THIS COURSE UNIT IS TAUGHT IN ROMANIAN LANGUAGE

1. Information about the program

1.1 Higher education institution	Politehnica University of Timisoara
1.2 Faculty ² / Department ³	Mechanics / Mechanics and Strength of Materials
1.3 Chair	—
1.4 Field of study (name/code ⁴)	Applied Engineering Sciences
1.5 Study cycle	Master
1.6 Study program (name/code/qualification)	Implants, Prostheses and Biomechanical Evaluation

2. Information about discipline

2.1 Name of discipline/The educational classe ⁵	Hemodynamics						
2.2 Coordinator (holder) of course activities	Alin TOTOREAN, PhD, Lecturer						
2.3 Coordinator (holder) of applied activities ⁶	Alin TOTOREAN, PhD, Lecturer						
2.4 Year of study ⁷	I	2.5 Semester	1	2.6 Type of evaluation	E	2.7 Type of discipline ⁸	DCAV

3. Total estimated time (direct activities (fully assisted), partially assisted activities and unassisted activities⁹)

3.1 Number of hours fully assisted/week	3 ,of which:	3.2 course	2	3.3 seminar/laboratory/project	1
3.1* Total number of hours fully assisted/sem.	42 ,of which:	3.2* course	28	3.3* seminar/laboratory/project	14
3.4 Number of hours partially assisted/week	,of which:	3.5 project, research		3.6 training	3.7 hours designing M.A. dizertation
3.4* Number of hours pasrtially assisted/ semester	,of which:	3.5* project of research		3.6* training	3.7* hours designing M.A. dizertation
3.8 Number of hours of unassisted activities/ week	3 ,of which:	Additional documentation in the library, on specialized electronic platforms, and on the field			1
		Study using a manual, course materials, bibliography and lecture notes			1
		Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays			1
3.8* Total number of hours of unasssited asctivities/ semester	42 ,of which:	Additional documentation in the library, on specialized electronic platforms, and on the field			14
		Study using a manual, course materials, bibliography and lecture notes			14
		Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays			14
3.9 Total hrs./week ¹⁰	6				
3.9* Total hrs./semester	84				
3.10 No. of credits	5				

4. Prerequisites (where applicable)

4.1 Curriculum	• Anatomy and Physiology (Biological Systems), Fluid Mechanics
4.2 Competencies	• Computer skills

5. Conditions (where applicable)

¹ The form corresponds to the Syllabus promoted by OMECTS 5703/18.12.2011 (Annex 3), updated based on the Specific Standards ARACIS of December 2016.

² The name of the faculty which manages the educational curriculum to which the discipline belongs

³ The name of the department entrusted with the discipline, and to which the course coordinator/holder belongs.

⁴ Fill in the code provided in HG no. 376/18.05.2016 or in HG similars annually updated.

⁵ The educational classes of disciplines (ARACIS – specific standards, art./paragraph 4.1.2.a) are: fundamental disciplines, field disciplines, majoring/specialization disciplines.

⁶ The applied activities refer to: seminar (S) / laboratory (L) / project (P) / practice/training (Pr).

⁷ The year of study to which the discipline is provided in the curriculum .

⁸ The types of disciplines (ARACIS – specific standards, art./paragraph 4.1.2.a) are: extended knowledge discipline / advanced knowledge discipline and synthetic discipline (DA / DCAV and DS) or art./paragraph 4.1.2 b) complementary discipline (DC)).

⁹ Within UPT, the number of hours from 3.1*, 3.2*,...,3.9* are obtained by multiplying by 14 (weeks) the number of hours from 3.1, 3.2,...., 3.9.

¹⁰ The total number of hours/week is obtained by summing up the number of hours from 3.1, 3.4 și 3.8.

5.1 of the course	•
5.2 to conduct practical activities	•

6. Specific competencies acquired through this discipline

Specific competencies	<ul style="list-style-type: none"> • C1. Hemodynamic characterization of blood flow in the cardiovascular system, in normal and pathological conditions. • C2. Characterization and classification of the investigation techniques used for the cardiovascular system. • C3. Characterization of different implants/prosthesis/devices used in the cardiovascular system therapy with emphasis on the hemodynamic efficiency. • C4. Students will be able to design an implant/prosthesis/device with good hemodynamic performance.
Professional competencies ascribed to the specific competencies	<ul style="list-style-type: none"> • C1. Appropriate use of the basic and advanced theoretical knowledge in Medical Engineering. • C2. Acquisition and processing of bio-medical data. • C3. Use of specialized software for numerical analysis of different cardiovascular and biological structures.
Transversal competencies ascribed to the specific competencies	<ul style="list-style-type: none"> • CT1. Honorable, responsible, ethical conduct, to ensure the reputation of the profession. • CT2. Identification and permanent documentation on continuing training opportunities in the field of activity and related fields, in correlation with the needs of the labor market. • CT3. Ability to work individually and in a team in an interdisciplinary environment, identifying roles and responsibilities in a team, demonstrating initiative and innovative skills.

7. Objectives of the discipline (based on the grid of specific competencies acquired)

7.1 The general objective of the discipline	<ul style="list-style-type: none"> • The analysis of cardiovascular system in normal and pathological conditions using the hemodynamic principles, Computational Fluid Dynamics and experimental Fluid Mechanics tools.
7.2 Specific objectives	<ul style="list-style-type: none"> • Hemodynamic characterization of cardiovascular system in normal and pathological conditions. • Hemodynamic characterization of therapeutical methods, techniques, implants/protheses/devices used for the cardiovascular system. • Numerical hemodynamic analysis of the cardiovascular system. • Experimental hemodynamic analysis of the cardiovascular system.

8. Content

8.1 Course	Number of hours	Teaching methods
Cardiovascular system (anatomy, physiology, pathology, investigation methods)	4	Presentation, demonstration, case reports, discussions, e-learning-Virtual Campus UPT
Fluid Mechanics of viscous fluid flow (physical properties of blood, governing equations of the blood flow)	6	
Hemodynamics of therapeutical techniques (stenting, bypass procedure, cardiac valve replacement)	6	
Numerical hemodynamics	8	
Experimental hemodynamics	4	

Bibliography ¹¹ 1. Totorean, A.F., Hemodinamică – note de curs, Politehnica Publishing House, Timișoara, 2019.		
2. Totorean, A.F., Bernad, S.I., Totorean, I.C., Metode numerice aplicate în investigarea sistemului cardiovascular. Hemodinamica bypass-ului aortocoronarian, Politehnica Publishing House, Timișoara, 2019.		
3. Bernad, S., Hemodinamica patologiei arterelor coronare, Krista Publishing House, Timisoara, 2016.		
4. Ginghină, C. (red.), Mic tratat de cardiologie, Romanian Academy Publishing House, Bucharest, 2017.		
8.2 Applied activities¹²	Number of hours	Teaching methods
Measurement of arterial pressure using classic and electronic sphygmomanometer, and the vascular Doppler equipment	2	Presentation, demonstration, case reports, experiments, simulations, discussions, e-learning-Virtual Campus UPT
Arterial Doppler echography and echocardiography - equipment and measuring principles presentation	2	
Patient-specific 3D model reconstruction based on Computed Tomography Angiography images	4	
Numerical analysis of blood flow in patient-specific vascular geometry	4	
Experimental analysis of fluid flow in coronary bypass model	2	
Bibliography ¹³ 1. Totorean, A.F., Hemodinamică – note de curs, Politehnica Publishing House, Timișoara, 2019.		
2. Totorean, A.F., Bernad, S.I., Totorean, I.C., Metode numerice aplicate în investigarea sistemului cardiovascular. Hemodinamica bypass-ului aortocoronarian, Politehnica Publishing House, Timișoara, 2019.		
3. Bernad, S., Hemodinamica patologiei arterelor coronare, Krista Publishing House, Timisoara, 2016.		

9. Corroboration of the content of the discipline with the expectations of the main representatives of the epistemic community, professional associations and employers in the field afferent to the program

The corroboration of the contents of the discipline is in full accordance with the expectations of the representatives of the epistemic community, of the professional associates and of the representative employers in the field afferent to the program. The corroboration of the educational offer with the needs of employers is in a permanent process of updating by maintaining permanently open lines of bilateral communication and by updating the content of the discipline in relation to the news and trends in the field.

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10. Evaluation

Type of activity	10.1 Evaluation criteria ¹⁴	10.2 Evaluation methods	10.3 Share of the final grade
10.4 Course	Exam	Written exam (10 topics)	50%
10.5 Applied activities	S:		
	L: Students will be	Presentation of the results obtained within	50%

¹¹ At least one title must belong to the department staff teaching the discipline, and at least one title must refer to a relevant work for the discipline, a national and international work that can be found in the UPT Library.

¹² The types of applied activities are those mentioned in 5. If the discipline contains more types of applied activities then they are marked, consecutively, in the table below. The type of activity will be marked distinctively under the form: „Seminar:”, „Laboratory:”, „Project:” and/or „Practice/Training:”.

¹³ At least one title must belong to the staff teaching the discipline.

¹⁴ The Syllabus must contain the evaluation method of the discipline, specifying the criteria, the methods and the forms of evaluation, as well as mentioning the share attached to these within the final mark. The evaluation criteria must correspond to all activities stipulated in the curriculum (course, seminar, laboratory, project), as well as to the methods of continuous assessment (homework, essays etc.)

	organized in teams, will perform numerical analysis (starting from 3D model reconstruction based on CT/MRI medical images to Computational Fluid Dynamics analysis and postprocessing the results) and will present their results.	the laboratory activities.	
	P:		
	Pr:		
	Tc-R¹⁵:		
10.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified ¹⁶)			
<ul style="list-style-type: none"> To pass the exam a minimum 50% of topics should be correctly solved. To pass the applied activity, students should present accurate solutions and results to their numerical analysis. 			

Date of completion

18.09.2020

**Course coordinator
(signature)**

**Coordinator of applied activities
(signature)**

**Head of Department
(signature)**

**Date of approval in the Faculty
Council ¹⁷**

**Dean
(signature)**

¹⁵ Tc-R= Homework-Reports

¹⁶ For this point turn to "Ghid de completare a Fişei disciplinei" found at: http://univagora.ro/m/filer_public/2012/10/21/ghid_de_completare_fisa_disciplinei.pdf

¹⁷ The approval is preceded by discussing the study program's board's point of view with redgards to the syllabus.