

99901731 定量生理学

1. 课堂讲授学时 **Lecture Hours**: 16
2. 课堂实验学时 **Laboratory Hours**: 10
3. 课下研讨学时 **Colloquia Hours**: 6
4. 学生课下投入学时 **Individual Study Hours**: 6
5. 学分 **Credits**: 2
6. 开课学年学期: 2025 年-2026 年 第二学期
7. 先修课程 **Prerequisite(s)**: NA
8. 课程概要 **Course Description**: This module explores the fundamentals of human physiology from an engineering perspective, focusing on cardiovascular and respiratory systems. It provides biomedical engineers with the pathophysiological understanding necessary for medical device innovation to address healthcare challenges of an aging population.
9. 课程预期学习成果 **Course Outcomes**:
 - (1) Describe the basic physiology of major living organs and systems
 - (2) Apply the understanding of human physiology to typical bioengineering problems
 - (3) Measure relevant physiological quantities under different conditions in a laboratory setting
 - (4) Understand the significance of measured physiological parameters
10. 教学内容与学时分配 **Course Content, Laboratories and Laboratory Hours** (有则填, 没有则不填), **Colloquia Hours** (有则填, 没有则不填):

Section 1: Cardiovascular System (5 hours)

 - General introduction to the Hemodynamics of vasculature system
 - Velocity of blood stream
 - Relationship between velocity and pressure
 - Relationship between pressure and flow
 - The Bernoulli equation
 - Hemodynamics Origin of Cardiovascular Diseases
 - The Venous and Microcirculation systems

Section 2: Cardiovascular System (5 hours)

 - Anatomy of heart
 - How muscles works
 - Filament-Sliding Mechanism or Cross-bridge cycle
 - Electrical excitation of heart
 - Cardiac cycle
 - Four quadrant diagram: integration of cardiac and vascular function

Section 3: Respiratory System (3 hours)

- Lung Anatomy
- Structure and function of the respiratory system
- Mechanical properties of the lung and chest wall
- Ventilation, perfusion
- Oxygen and Carbon transport

Section 4: Respiratory System (3 hours)

- Pulmonary blood flow
- Ventilation-perfusion relationships
- Oxygen and carbon dioxide transport
- The Oxyhemoglobin dissociation curve

Section 5: Laboratory Experiments (14 hours)

- Introduction of computational modelling of human cardiovascular system (2 hours)
- Image segmentations (2 hours)
- Model reconstruction and processing (2 hour)
- Mesh generation (1 hour)
- CFD simulation and post-processing (4 hours)
- Result discussion (3 hours)

Section 7: Presentation (2 hours)

- Group presentations (2 hours)

11. 考核与成绩评定 **Grading:**

- 10% - peer review
- 20% group project presentations
- 10% in-class quiz (cardiovascular)
- 10% in-class quiz (respiratory)
- 20% laboratory experiments
- 30% group presentations

12. 教材, 参考书 **Text & Reference Book:** 作者, 书名, 版本, 年份, 国际标准书号 ISBN

(1) Bruce M. Koeppen, Berne&Levy Physiology, 8th Edition, 2023, 978-0323847926

(2) Bruce R. Munson, Theodore H. Okiishi, Wade W. Huebsch, Alric P. Rothmayer, Fluid Mechanics, 7th Edition, 2013, 9781118318676

(3) Gerard J. Tortora, Bryan H. Derrickson, Principles of Anatomy and Physiology, 16th Edition, 2020, 9781119662792

13. 编写教师 **Course Lecturer:**

Leo Hwa Liang, 张帅通

编写教师 **Course Lecturer** (签字):

张帅通