

Artificial Organ Engineering (3 Credits)

人造器官工程

Instructor	Poh Foong LEE, Mechanical Engineering Dept., Univ. Tunku Abdul Rahman, (leepf@utar.edu.my)		
Synopsis	<p>The impact of artificial organs on human life is overwhelming! Every year, they affect the lives of some 25 million people worldwide. The commonly accepted definition of an artificial organ is that of an engineered tissue, organ or device. It is implanted into or integrated with a living body for a specific function to enable the recipient a return to a normal or enhanced life, or to continue living on either a temporary or permanent basis. Examples of artificial organs being deployed include enhancing a person's ability for self-care (artificial limb), interacting normally with society (glasses – yes, these too), improving physical appearance (cosmetic restoration after cancer surgery), providing life-support (awaiting transplant), increasing competitiveness and/or survivability (exoskeleton), etc. The aims of the course are three folds: distinguish various and current state-of-art technologies for artificial organs, describe the functions of artificial heart valves, artificial heart, cardiac assist devices, pacemaker, artificial kidney and artificial heart, neuroprosthesis and discuss design considerations of bio artificial organs that includes a fundamental mathematical modeling of artificial kidney and artificial lung.</p>		
Offering	2018 July Semester (Julmester)		
Audience	Year 3 & 4 Undergraduate and Graduate Students		
Classroom	Room TBA, Teaching Bldg. No. TBA, Peking University		
Schedule	Class: 1-4 PM, M-F, July 2–20, 2018	Final Exam: 1-4 PM, Sat, July 21, 2018	Total Contact Hours: 45
Objective	<p>Students will be exposed to current state-of-art technologies for artificial organs. They will learn the varying functions of artificial heart and valves, cardiac devices, pacemaker, artificial kidney and artificial heart. They will also learn the design considerations that include a fundamental mathematical modelling of artificial kidney and artificial lung.</p>		
Topics	<ol style="list-style-type: none"> 1. Introduction to artificial organs engineering 2. Basic function of a kidney – principles of haemodialysis 3. Performance of mass transfer in artificial kidney 4. Operation of dialysis device through kinetic modelling of urea 5. Basic function of the lung – principles of cardiopulmonary diversion 6. Transportation of gases in blood 7. Design of artificial lung – membrane oxygenator 8. Implantable membrane oxygenator 9. Basic function of the heart – design of artificial heart valves 10. Prosthetic heart valves 11. Evaluation of prosthetic heart valves 12. Heart assist technology 13. Neuroprosthesis 		
References	<ol style="list-style-type: none"> 1. Subrata Pal. (2014). <i>Design of Artificial Human Joints & Organs</i>. Springer Publishers. 2. Maria Cristina Annesini, Luigi Marrelli javascript:void(0)(2016). <i>Artificial Organ Engineering</i>. 1st Ed. Springer Publisher. 3. Bronzino, J. D. (2006). <i>The Biomedical Engineering Handbook – Tissue Engineering & Artificial Organs</i>. Taylor & Francis. 4. Miller, G. E. (2006). <i>Artificial organs, synthesis lectures on biomedical engineering #4</i>. Morgan & Claypool Publishers 		
Grading	Homework Assignments	20%	
	Project Assignment	20%	
	• Interim Project Assessment (10%)		
	• Final Project Assessment (10%)		
	Midterm Exam	20%	
	Final Exam	40%	
	Total	100%	