Course Information	
Course title	Advanced Topics in Physical Chemistry
Semester	111-2
Designated for	COLLEGE OF ENGINEERING TIGP-MOLECULAR SCIENCE AND TECHNOLOGY
Instructor	DAVID TAI-WEI WU
Curriculum Number	ChemE7041
Curriculum Identity Number	524EM6180
Class	
Credits	3.0
Full/Half Yr.	Half
Required/ Elective	Elective
Time	Wednesday 7,8,9(14:20~17:20)
Remarks	The upper limit of the number of students: 50.
Course introduction video	
Table of Core Capabilities and Curriculum Planning	Table of Core Capabilities and Curriculum Planning
Course Syllabus	
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Course Description	This course will provide an introduction to key advanced topics in physical chemistry, including in quantum mechanics, statistical mechanics, kinetics and soft matter.
Course Objective	This course aims to introduce advanced topics in physical chemistry that are of active and central interest at the frontiers of research in physical sciences and engineering, as well as their applications in materials and biology.
Course Requirement	Undergraduate Physical Chemistry
Student Workload (expected	

study time outside of class per week)	
Office Hours	
References	No assigned textbook.
Designated reading	Levine “Quantum Chemistry” ; Chandler “Introduction to Modern Statistical Mechanics” ; Peters “Reaction Rate Theory and Rare Event Simulation” ; Rubinstein “Polymer Physics”; Brochard-Wyart “Essentials of Soft Matter Science”
Grading	

No.	Item	%	Explanations for the conditions
1.	Participation & Reading	20%	
2.	Assignments	0%	
3.	Midterm	40%	
4.	Final	0%	
5.	Term Paper & Abstract	40%	

Progress

Week	Date	Topic
Week 1	2/22	Introduction
Week 2	3/1	Quantum Entanglement, Bell’s Inequality and Quantum Computation
Week 3	3/8	Density Functional Theory
Week 4	3/15	Spin-Statistics, Fermi Liquids, and Bose-Einstein Condensates
Week 5	3/22	Onsager Reciprocal Relations, Fluctuation Dissipation Theorem
Week 6	3/29	Non-equilibrium fluctuation relations (Jarzynski, Crooks, single-molecule experiments)
Week 7	4/5	National Holiday
Week 8	4/12	Active Matter
Week 9	4/19	Critical Phenomena and RG / Coarse-Graining & Effective Hamiltonians
Week 10	4/26	Midterm Journal Article Presentations (One-page Term Paper abstract due)
Week 11	5/3	Rate Theory (Transition State Theory and Reactive Flux Theory)
Week 12	5/10	Rare Event Methods (Path Sampling and Path Ensembles)
Week 13	5/17	Classical Nucleation Theory
Week 14	5/24	Polymer Statistics, Elasticity and Thermodynamics
Week 15	5/31	Colloids and Entropic Phase Transitions (Term Paper due)
Week 16	6/7	Final Exam