

## Tamkang University Academic Year 111, 1st Semester Course Syllabus

Course Title	SPECIAL TOPICS IN CONDENSED MATTER PHYSICS	Instructor	HSUEH, HUNG-CHUNG
Course Class	TSXAD1A DOCTORAL PROGRAM IN APPLIED SCIENCES, 1A	Details	<ul style="list-style-type: none"> <li>◆ General Course</li> <li>◆ Selective</li> <li>◆ One Semester</li> </ul>
Relevance to SDGs	SDG4 Quality education		
<b>Departmental Aim of Education</b>			
To cultivate high-level spiritual talents demanded by industry and academia as well as with solid knowledge in material science and ability to do transnational and interdisciplinary research independently.			
<b>Subject Departmental core competences</b>			
<p>A. To have solid knowledge and ability to carry out relevant research in material science. (ratio:30.00)</p> <p>B. To acquire capabilities in comprehensive vision and conducting transnational interdisciplinary research.(ratio:25.00)</p> <p>C. To obtain ability in innovation, independent thinking and independent research. (ratio:20.00)</p> <p>D. To have good oral and written skills as well as a good sense in teamwork.(ratio:20.00)</p> <p>E. To have a comprehensive understanding in professional morality and ethics.(ratio:5.00)</p>			
<b>Subject Schoolwide essential virtues</b>			
<p>1. A global perspective. (ratio:20.00)</p> <p>2. Information literacy. (ratio:15.00)</p> <p>3. A vision for the future. (ratio:20.00)</p> <p>4. Moral integrity. (ratio:5.00)</p> <p>5. Independent thinking. (ratio:20.00)</p> <p>6. A cheerful attitude and healthy lifestyle. (ratio:5.00)</p> <p>7. A spirit of teamwork and dedication. (ratio:10.00)</p> <p>8. A sense of aesthetic appreciation. (ratio:5.00)</p>			

Course Introduction	Based on the fundamental quantum many-body theory, this lecture will cover the mean-field theory, collective electronic excitations, and many-body perturbation theory of electronics in condensed matter systems.
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**The correspondences between the course's instructional objectives and the cognitive, affective, and psychomotor objectives.**

Differentiate the various objective methods among the cognitive, affective and psychomotor domains of the course's instructional objectives.

I. Cognitive : Emphasis upon the study of various kinds of knowledge in the cognition of the course's veracity, conception, procedures, outcomes, etc.

II.Affective : Emphasis upon the study of various kinds of knowledge in the course's appeal, morals, attitude, conviction, values, etc.

III.Psychomotor: Emphasis upon the study of the course's physical activity and technical manipulation.

No.	Teaching Objectives	objective methods
1	Students will learn the application of quantum many-body theory in condensed matter systems	Cognitive

The correspondences of teaching objectives : core competences, essential virtues, teaching methods, and assessment

No.	Core Competences	Essential Virtues	Teaching Methods	Assessment
1	ABCDE	12345678	Lecture, Discussion	Study Assignments, Discussion(including classroom and online), Report(including oral and written)

Course Schedule

Week	Date	Course Contents	Note
1	111/09/05 ~ 111/09/11	Introduction	
2	111/09/12 ~ 111/09/18	Group representation beyond translation	
3	111/09/19 ~ 111/09/25	Homogeneous interacting electron gas and beyond	
4	111/09/26 ~ 111/10/02	Homogeneous interacting electron gas and beyond	

5	111/10/03 ~ 111/10/09	Electron dynamics and topology in crystals	
6	111/10/10 ~ 111/10/16	Electron dynamics and topology in crystals	
7	111/10/17 ~ 111/10/23	Electron dynamics and topology in crystals	
8	111/10/24 ~ 111/10/30	Electron-Phonon Interactions	
9	111/10/31 ~ 111/11/06	Midterm Exam Week	
10	111/11/07 ~ 111/11/13	Electron-Phonon Interactions	
11	111/11/14 ~ 111/11/20	Many-body technique-Green's function	
12	111/11/21 ~ 111/11/27	Many-body technique-Green's function	
13	111/11/28 ~ 111/12/04	Many-body technique-Green's functions	
14	111/12/05 ~ 111/12/11	Magnetic behaviors in solids	
15	111/12/12 ~ 111/12/18	Magnetic behaviors in solids	
16	111/12/19 ~ 111/12/25	GW Approximation	
17	111/12/26 ~ 112/01/01	Final Exam Week	
18	112/01/02 ~ 112/01/08	教師彈性補充教學： Final report	
Requirement			
Teaching Facility		Computer, Projector	
Textbooks and Teaching Materials		Teaching notes on the iClass	
References		A Guide to Feynman Diagram in the Many-Body Problem / Richard D. Mattuck, 2nd ed., Dover (1992) Quantum Many-Particle Systems / John W. Negele and Henri Orlando, Addison-Wesley (1988) Many-Particle Physics / Gerald D. Mahan, 3rd ed., KA/PP (2000) Interacting Electrons / Richard M. Martin, Lucia Reining, and David M. Ceperley, Cambridge (2016) Fundamentals of Many-body Physics Principles and Methods/ Wolfgang Nolting, Springer-Verlag (2009)	

Number of Assignment(s)	3 (Filled in by assignment instructor only)
Grading Policy	<ul style="list-style-type: none"> <li>◆ Attendance : 20.0 %</li> <li>◆ Mark of Usual : 30.0 %</li> <li>◆ Midterm Exam : %</li> <li>◆ Final Exam : %</li> <li>◆ Other (exercises and report) : 50.0 %</li> </ul>
Note	<p>This syllabus may be uploaded at the website of Course Syllabus Management System at <a href="http://info.ais.tku.edu.tw/csp">http://info.ais.tku.edu.tw/csp</a> or through the link of Course Syllabus Upload posted on the home page of TKU Office of Academic Affairs at <a href="http://www.acad.tku.edu.tw/CS/main.php">http://www.acad.tku.edu.tw/CS/main.php</a>.</p> <p><b>※ Unauthorized photocopying is illegal. Using original textbooks is advised. It is a crime to improperly photocopy others' publications.</b></p>