Hong Kong Baptist University
Faculty of Science – Department of Physics

Title (Units): **SCIP 4005/7010 INTERDISCIPLINARY TOPICS IN SCIENCE – ORGANIC ELECTRONICS (3, 3, 1)**

Course Aims: This interdisciplinary course describes the fundamentals of organic semiconductor materials, molecular design, synthesis, material processes, discusses the operation principle of organic semiconductor devices, enables students to become familiar with relevant terminology and be aware of the latest progresses in the emerging field of organic electronics, including functional organic semiconductors for applications in solar cells, transistors, sensors, advanced flat panel displays, and next generation solid state lighting etc.

Pre-requisite: CHEM 2008-9 or CHEM 2036 or PHYS 2006 or PHYS 3015 or consent of instructors

Course Reviewed by: Prof. Furong Zhu, Prof. Shu-Kong So and Prof. Ricky M. S. Wong

Course Intended Learning Outcomes (CILOs):
Upon successful completion of this course, students should be able to:

No.	Upon successful completion of this course, students should be able to:
1.	Describe molecular design, synthesis, structure-property relationships, material process and characterization.
2.	Explain the excitonic processes and charge transport properties in organic semiconductor materials and devices.
3.	Use fundamental properties of organic semiconductor materials to discuss the operation principles and architectures of different organic semiconductor devices and their applications.
4.	Be able to read and understand scientific literatures in the field, and to conduct a literature review on certain relevant research topics.

Teaching & Learning Activities (TLAs)

CILOs	**TLAs will include the following:**
1–4	Lectures to cover organic semiconductor materials, devices and applications.
1–4	Tutorials and seminars to cover the more open-ended topics. Students may be required to attend some of the Science Faculty colloquiums.
1–4	Homework assignments. Students are assigned readings and/or problem sets.
1–4	Student project presentations and reports. Students may be required to do mini-projects.

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Assessment Methods (AMs):

No.	Assessment Methods	Weighting	CILOs to be addressed	Remarks
1	Continuous assessment (assignments and quizzes)	30%	1-4	Problem assignments and quizzes are designed to measure how well the students have learned the basics of organic electronics.
2	Presentation and report * (Mini-projects and reading assignments)	20%	1-4	Presentations of the mini-projects and reading assignments are graded based on students' understanding on the topics and critical discussions.
3	2-hour final examination	50%	1-4	Final examination questions are designed to measure how well the students have learned the concept, theory and application of organic semiconductors and devices through this interdisciplinary course.

*For assessment of RPg students, additional dissertations of the mini-projects are required.

Learning Outcomes and Weighting:

Content	LO No.	Teaching (in hours)
1. Introduction to organic electronics	1–4	2
2. Chemistry of organic materials	1–4	6
3. Molecular design, synthesis and structure-property relationships	1–4	6
4. Fundamental properties of organic semiconductors	1–4	6
5. Organic semiconductor devices	1–4	12
6. Applications	1–4	6

Textbook: None.

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Suggested References:

1. S.J. Sun, and L.R. Dalton, *Introduction to Organic Electronic and Optoelectronic Materials and Devices*, CRC Press, 2008.
2. F. So, *Organic Electronics: Materials, Processing, Devices and Applications*, CRC Press, 2010.
3. Z.G. Li, and H. Meng, Organic *Light-emitting Materials and Devices*, Taylor & Francis, 2007.
4. S.C. Jain, M. Willander, and V. Kumar, *Conducting Organic Materials and Devices*, Elsevier/Academic Press, 2007.
5. W.S. Wong, and A. Salleo, *Flexible Electronics: Materials and Applications*, Springer, 2009.
6. K. Mullen, and U. Scherf, *Organic Light Emitting Devices: Synthesis, Properties and Applications*, Wiley-VCH, 2006.

Course Contents

	Topics	Instructors	Hours
I.	Introduction – What and why is organic electronics – Fundamental material science and technical challenges	Staff from CHEM and PHYS	2
II.	Chemistry of organic materials – Comparison with inorganic congeners – Properties and functions – Molecular orbital theory	Staff from CHEM	6
III.	Molecular design, synthesis and structure-property relationships – Organic small-molecules – Polymers – Metal-organic compounds	Staff from CHEM	6
IV.	Fundamental properties of organic semiconductors – Excitons and excitonic energy transfer processes – Charge transport properties	Staff from PHYS	6
V.	Organic semiconductor devices – Organic light-emitting diodes, organic solar cells, organic field-effect transistors, organic photodetectors etc.	Staff from PHYS	12
VI.	Applications – Advanced flat panel displays – Solid state lighting – Emerging printable electronics	Staff from PHYS	6