Tsinghua-Berkeley Shenzhen Institute (TBSI)

PhD Program Design

(Approved in June, 2018, Applicable to Class 2018)

1. SCOPE

This Ph.D. program is applicable for all doctoral students (including the international and those from Hong Kong, Macau and Taiwan) enrolled in Tsinghua-Berkeley Shenzhen Institute (TBSI) in any of the following disciplines: Environment Science and New Energy Technology, Data Science and Information Technology, Precision Medicine and Healthcare.

2. OBJECTIVE

Cultivate doctoral students to be **academic leaders** and **future industrial scientists** capable of solving regional and global challenging issues.

3. NORMATIVE TIME

The typical normative time is 4 to 5 years for doctoral students without a Master's degree and 3 to 4 years for those with a Master's degree.

4. EDUCATION FORMAT AND DEGREE AWARDING

This is an English program with all technical courses taught in English. Doctoral students will be advised by advisor(s) (i.e., advisor group) formed by professors from Tsinghua University, UC Berkeley, and TBSI full-time faculty members. Dissertation should be completed in both Tsinghua University and UC Berkeley.

After the completion of the program requirements and upon the approval from the Academic Advisory Committee (AAC) and Tsinghua University, doctoral students will be awarded a doctoral degree and a diploma from Tsinghua University and a study certificate from UC Berkeley.

5. CURRICULUM DESIGN AND CREDIT REQUIREMENTS

At the beginning of the first semester of residency, students must select, in consultation with advisor(s), one educational concentration within the students' discipline as the major educational focus before submitting the plan of study. This selected concentration will determine the major and minor courses taken by the students.

Each concentration is a combination of an interdisciplineary discipline and a research track. There are 3 interdisciplinary disciplines representing the 3 centers. Each discipline has 3 concentrations, which are based on the following 3 tracks of research foundation:

1) Track 1: Physics and Chemistry
2) Track 2: Mathematics and Data
3) Track 3: Life Sciences

These 3 tracks when intersected with the three disciplines result in 9 educational concentrations. D1T1is the physics and chemistry concentration under the interdisciplinary discipline of Environmental Science and New Energy Technology. D1T2 is the mathematics and data concentration under the interdisciplinary discipline of Environmental Science and New Energy Technology. D1T3 is the life and sciences concentration under the interdisciplinary discipline of Environmental Science and New Energy Technology. D2T1 is the physics and chemistry concentration under the interdisciplinary discipline of Data Science and Information Technology. D2T2 is the mathematics and data concentration under the interdisciplinary discipline of Data Science and Information Technology. D2T3 is the life and sciences concentration under the interdisciplinary discipline of Data Science and Information Technology. D3T1 is the physics and chemistry concentration under the interdisciplinary discipline of Precision Medicine and Healthcare. D3T2 is the mathematics and data concentration under the interdisciplinary discipline of Precision Medicine and Healthcare. D3T3 is the life and sciences concentration under the interdisciplinary discipline of Precision Medicine and Healthcare. These 9 concentrations are shown in the table below.

Discipline / **Track**	**Discipline 1** Environmental Science and New Energy Technology	**Discipline 2** Data Science and Information Technology	**Discipline 3** Precision Medicine and Healthcare
• Physics-Chemistry	• **D1T1**: Physics-Chemistry Intersected with Environmental Science and New Energy Technology	• **D2T1**: Physics-Chemistry Intersected with Data Science and Information Technology	• **D3T1**: Physics-Chemistry Intersected with Precision Medicine and Healthcare
• Mathematics-Data	• **D1T2**: Mathematics-Data Intersected with Environmental Science and New Energy Technology	• **D2T2**: Mathematics-Data Intersected with Data Science and Information Technology	• **D3T2**: Mathematics-Data Intersected with Precision Medicine and Healthcare
• Life-Sciences	• **D1T3**: Life-Sciences Intersected with Environmental Science and New Energy Technology	• **D2T3**: Life-Sciences Intersected with Data Science and Information Technology	• **D3T3**: Life-Sciences Intersected with Precision Medicine and Healthcare

Each concentration requires two types of course credits: major course units and minor course units.

Full-time students enrolled in the TBSI Ph.D. Program are required to take a minimum of 29 units of coursework, including a minimum of 7 units of common mandatory courses, 4 units of mandatary sessions, and a minimum of 18 units of technical courses from selected educational concentration. These 18 technical units include at least 12 major units and 6 minor units. International students are requirted to take a two-unit Chinese course in addition to the 29 units of coursework. See appendices for details of curriculum design.

For Class 2018, students with a Master's degree or Tsinghua postgraduate students may be exempted from no more than 4 technical courses that have been taken during their Master's programs for up to 9 units (at most 6 major units and at most 3 minor units) upon the approval of course instructor(s) and their advisor(s).

For Class 2015, 2016 and 2017, students with a Master's degree or Tsinghua postgraduate students may be exempted from no more than 9 units of technical courses that have been taken during their Master's programs upon the approval of course instructor(s) and their advisor(s).

In addition, students who have taken *Introduction to Dialectics of Nature* can apply for 1-unit exemption of social science courses. This 1 unit is beyond the aboved 9 units.

6. SCHEDULE

1) Plan of Study

   Within the first three weeks, all Ph.D. students need to complete the plan of study for the curriculum advised and approved by the advisor(s). The plan of study will be checked by the head of Student Education Office (SEO) before it can be filed in SEO. During the registration of each semester, students can modify their plan of study after pre-approval from advisor(s) and the head of SEO and must submit the revised plan of study to SEO for final approval.

2) Preliminary Requirement (Prelim)

   All Ph.D. students are expected to take and pass TBSI preliminary examination within 2 years after admission. The exam committee consists of TBSI core-PIs who will evaluate students' level of mastery of professional knowledge required for academic research in specific areas. Students must pass the Preliminary Requirement before taking the Qualifying Examination and apply for study at UC Berkeley.

3) Qualifying Examination (Quals) and Progress

   The Qualifying Examination is an important checkpoint meant to show that students are on a promising research progress toward the Ph.D. degree. The Qualifying Examination includes a written report and a presentation of dissertation proposal and ongoing work. The Quals Exam Committee of a Ph.D. student includes four TBSI faculty members designated by the student's advisor(s). This committee shall not only evaluate the student's dissertation proposal but also his/her dissertation progress.

   Quals Deadlines: Students should pass the Quals before the end of their fourth year of program study. Passing the Quals one year or more in advance is recommended. After passing the Quals, a student must spend at least one semester of residency at TBSI before defending his/her dissertation.

4) Dissertation and Final Defense

   - Students shall spend a minimum of two years of actual research on their doctoral dissertation. Doctoral dissertation shall be written in English.

- Dissertation review: The dissertation should be reviewed by the advisor(s) firstly and then peer-reviewed by five experts. Prior to applying for defense, a Ph.D. candidate must receive all reviews.

- In addition to dissertation review, a doctoral candidate needs to apply, schedule, and give a final defense to his/her dissertation. A defense committee must be nominated by the advisor(s) and approved by the AAC chair.

- After passing the final defense, a doctoral candidate can submit his/her Ph.D. degree application to the Academic Degree Committee of Tsinghua University.

APPENDICES

Appendix I: Ph.D. Coursework

Full-time students enrolled in the TBSI Ph.D. Program are required to take a minimum of 29 units of coursework, including a minimum of 7 units of common mandatory courses, 4 units of mandatary sessions, and a minimum of 18 units of technical courses from selected educational concentration. These 18 technical units include at least 12 major units and 6 minor units. International students are requirted to take a two-unit Chinese course in addition to the 29 units of coursework.

For Class 2018, students with a Master's degree or Tsinghua postgraduate students may be exempted from no more than 4 technical courses that have been taken during their Master's programs for up to 9 units (at most 6 major units and at most 3 minor units) upon the approval of course instructor(s) and their advisor(s).

For Class 2015, 2016 and 2017, students with a Master's degree or Tsinghua postgraduate students may be exempted from no more than 9 units that have been taken during their Master's programs upon the approval of course instructor(s) and their advisor(s).

In addition, students who have taken *Introduction to Dialectics of Nature* can apply for 1-unit exemption of social science courses. This 1 unit is beyond the aboved 9 units.

1) Common Mandatory Courses

- Social Science [5 units]

  1）Political Theory Courses[(a)]:

  - Contemporary Philosophy in China (90680032)_____[2 units]
  - Introduction to Dialectics of Nature (60680021)_____[1 unit]

  2）English Academic Writing and Communication [(b)] _____[2 units]

- Professional Development [1 unit]
  - Professional Development and Presentation (66000022)_____[2 units]
  - Creative Innovation, Entrepreneurship and Venture Capital (66000011)_____[1 unit]
- Capstone Project [(c)] [1 unit]
  - Capstone Project (76000041)_____[1 unit]

2）Mandatory Sessions [4 units]

- Preliminary Examination_____[1 unit]
- Qualifying Examination_____[1 unit]

- Academic Activity [d] _____ [2 units]

3）Technical Courses from Selected Educational Concentration [minimum of 18 units]

- All doctoral students must finish one 1-unit 100-level course from selected concentration (track). This one unit can be used as either a major or minor unit, but not both.
- Major "**M**" courses under the selected concentration _____ [12 units]
- Minor "m" courses under the selected concentration _____ [6 units]

4）Complementary Courses

Doctoral students without prerequisite background knowledge or undergraduate course(s) will be required by advisor(s) to take complementary course(s) which cannot be counted as the technical course units for fulfilling the Ph.D. coursework requirement.

(a) Note: Students from Hong Kong, Macau, and Taiwan can choose the listed political theory courses; or they can take courses listed under "General Introduction of China" (Course No. 00000007, 2-3 units) to replace the political theory courses, and after taking these courses, technical courses can be taken to make up the remaining units.

International students can choose courses listed under "General Introduction of China" (Course No. 00000007, 2 to 3 units) to replace the political theory courses. After taking these courses, technical courses can be taken to make up the remaining units.

Detailed requirements and list of "General Introduction of China" courses can be found in the document "Overview of the Courses Exempted for Students from Hong Kong, Macau, and Taiwan, and Interenational Students (Postgraduate) of Tsinghua University".

(b) Note: In addition to taking *English Academic Writing and Communication*, international students must also meet the Chinese Language requirement by providing proofs of Chinese language proficiency or taking *Chinese Course*, depending on the students' Chinese language level.

(c) Note: Students are encouraged to form interdisciplinary teams to study and try to solve interdisciplinary open problems or industry-involved projects.

(d) Note: TBSI encourages Ph.D. students to attend academic activities. The academic activity requirement includes two categories. The first category consists of important and mandatory activities, which are organized by TBSI; and all students must participate. The other category is a series of research seminars. Students must attend at least 8 seminars per semester. Students should write a brief summary with no less than 300 words for each seminar attended. A final report containing all summaries and proofs of attendance must be submitted to SEO at the end of each semester. This Academic Activity course is held every semester and will be graded as

Pass or Fail. Students could earn at most 1 unit per year. 2 units are required for the Ph.D. degree program.

Appendix II. Course List for Nine Educational Concentrations

The following table lists all TBSI technical courses. Whether a course is major or minor depends on a student's selected concentration. The 9 concentrations are Columns 3 to 11 of the following table. Each student should follow the column corresponding to his/her selected concentration when deciding the major and minor courses to meet the minimum 12 major and 6 minor unit requirements. For example, a student of D1T3 (Discipline 1 and Track 3) should follow the 5th column in the table. The last column ("M.S. Only"), if checked, restricts the corresponding technical course(s) to M.S. students.

In addition to the courses listed in the following table, other technical courses within TBSI approved by advisor(s) may also meet certain unit requirements.

Courses are grouped based on track. Notation: "M" means Major course and "m" minor course.

Courses			**Discipline 1** Environmental Science and New Energy Technology			**Discipline 2** Data Science and Information Technology			**Discipline 3** Precision Medicine and Public Health				
Track One:	**Course No.**	**Units**	**D1T1** Physics-Chem	**D1T2** Math-Data	**D1T3:** Life-Sciences	**D2T1** Physics-Chem	**D2T2** Math-Data	**D2T3** Life-Sciences	**D3T1** Physics-Chem	**D3T2** Math-Data	**D3T3** Life-Sciences	**PhD Only**	**MS Only**
Introduction of physics chemistry disciplines 物理化学学科介绍		1	**M**	m	m	**M**	m	m	**M**	m	m		
Nano-energy Materials 纳米能源材料	86000012	2	**M**	m	m	**M**	m	m	**M**	m	m		
Thermal Physics and Engineering 热物理学与工程	86000021	1	**M**	m	m	**M**	m	m	**M**	m	m		
Dynamics of Environmental Systems: Principles of Mass Transformation and Energy Flow 环境系统与过程原理	86000032	2	**M**	m	m	m	m	m	m	m	m		

Sustainable Development: Ethics, Physics and Technology 可持续发展：伦理，机理和应用技术	86000241	1	**M**	**M**	**M**	**M**	m	m	**M**	m	m		
Chaos and Complexity – System Dynamics Approach 混沌和复杂性--系统动力学方法	86000651	1	**M**	**M**	**M**	**M**	**M**	m	**M**	**M**	m		
Computational Materials and Materials Genome Initiative 计算材料学与材料基因组工程	86000373	3	**M**	m	m	**M**	m	m	**M**	m	m		
Materials Physics 材料物理	86000433	3	**M**	m	m	**M**	m	m	**M**	m	m		
Materials Chemistry 材料化学	86000383	3	**M**	m	m	**M**	m	m	**M**	m	m		
Principle of Environmental Behavior 环境行为学原理	86000312	2	**M**	m	m	**m**	m	m	**m**	m	m		
Advanced Materials Characterization: Principles and New Developments 先进材料表征：原理和最新进展	86000423	3	**M**	m	m	**M**	m	m	**M**	m	m		
Materials and Devices of Energy Storage and Conversion 能源储存与转化：材料和器件	86000411	1	**M**	m	m	**M**	m	m	**M**	m	m		
MEMS and Its Application MEMS及其应用	86000103	3	**M**	**M**	**M**	**M**	**M**	**M**	**M**	m	m		
Materials Science and Engineering 材料科学与工程	86000663	3	**M**	m	m	**M**	m	m	**M**	m	m		
Micro Sensors 微传感器	86000122	2	**M**	**M**	**M**	**M**	**M**	**M**	**M**	m	m		
Introduction of Photonics 光电子概论	86000523	3	**M**	m	m	**M**	m	m	**M**	m	m		
Nanomaterials and Nanotechnology 纳米材料与技术	86000533	3	**M**	m	m	**M**	m	m	**M**	m	m		

Optical Fiber Communications 光纤通信	86000573	3	**M**	m	m	**M**	m	m	**M**	m	m		
Nanoscale Fabrication and Optoelectronic Devices 纳米加工和光电子器件导论	86000322	2	**M**	m	m	**M**	m	m	**M**	m	m		
Track Two：			**D1T1:**	**D1T2：**	**D1T3：**	**D2T1:**	**D2T2：**	**D2T3：**	**D3T1:**	**D3T2：**	**D3T3：**		
Energy-Environment and Data-Information 100 level course 能源环境与数据信息概论		1	m	**M**	m	m	**M**	m	m	**M**	m		
Fundamentals of Applied Information Theory 应用信息论基础	86000132	2	m	**M**	m	**M**	**M**	**M**	m	**M**	m		
Introduction of Smart Grid 智能电网导论	86000042	2	**M**	**M**	**M**	**M**	**M**	**M**	m	**M**	m		
Supply Chain Design and Management 供应链设计与管理	86000054	4	m	**M**	m	**M**	**M**	**M**	m	m	m		
Computational Photography 计算摄像学	86000603	3	m	m	m	**M**	**M**	**M**	m	m	m		
Introduction to Stochastic Processes 随机过程概论	86000082	2	m	**M**	m	m	**M**	m	m	**M**	m		
Introduction to Probability Theory 概率论	76000073	3	m	**M**	m	**M**	**M**	**M**	m	**M**	m		
Optimization Methods for Power Systems 电力系统优化方法论	86000451	1	m	**M**	**M**	m	**M**	m	m	m	m		
Markov Chains: Theory and Applications 马尔科夫链：理论与应用	86000471	1	m	**M**	m	m	**M**	m	m	**M**	m		

Discrete-Event Simulation 离散事件系统仿真	86000493	3	m	**M**	m	**M**	**M**	**M**	m	**M**	m		
Inference and Information 信息推论	86000513	3	m	**M**	m	m	**M**	m	m	m	m		
Learning from Data 数据学习	86000503	3	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**		
Distributed Control and Optimization of Power Systems 电力系统分布式控制与优化	86000583	3	m	**M**	m	**M**	**M**	**M**	**M**	**M**	m		
Mathematical Statistics and Application in R 数理统计与 R 语言应用	86000563	3	**M**	**M**	**M**	**M**	**M**	**M**	m	**M**	m		
Introduction to Queuing Theory and its Applications 排队论及其应用	86000593	3	m	**M**	m	**M**	**M**	**M**	m	m	m		
Seminar in Data Science and Information Technology 数据科学与信息技术讨论课	86000362	2	m	**M**	m	**M**	**M**	**M**	m	**M**	m		
Geometric and Topological Data Analysis 几何与拓扑数据分析	86000391	1	m	**M**	m	**M**	**M**	**M**	m	**M**	m		
Fundamentals of Digital Image and Video Processing 数字图像与视频处理	86000633	3	m	**M**	m	**M**	**M**	**M**	m	**M**	m		
Operations Research 运筹学	76000093	3	m	**M**	m	**M**	**M**	**M**	m	m	m		
Estimation and Control of Dynamical Systems 动力系统的评价与控制	86000643	3	m	**M**	m	m	**M**	m	m	**M**	m		
Advanced Managerial Economics 高级管理经济学	86000072	2	m	M	m	m	**M**	m	m	**M**	m		

Introduction to Financial Engineering 金融工程概论	86000092	2	m	**M**	m	m	**M**	m	m	**M**	m		
Foundations for Big Data Analytics 大数据分析基础	86000152	2	m	**M**	m	**M**	**M**	M	m	**M**	m		
ITS and High-accuracy Positioning Technologies 智能交通高精度定位	86000062	2	m	**M**	m	m	**M**	m	m	**M**	m		
Next-Generation of Internet and Web 下一代互联网	86000143	3	m	**M**	m	m	**M**	m	m	**M**	m		
Mobile and Pervasive Computing 移动设备和普适计算	86000111	1	m	**M**	m	m	**M**	m	m	**M**	m		
Energy Systems and Control 能源系统与控制	86000251	1	m	**M**	m	m	**M**	m	m	**M**	m		
Analysis and Optimization on Logistics System 物流系统分析及优化	86000292	2	m	**M**	m	m	**M**	m	m	**M**	m		
Introduction to Advanced ITS 现代智能交通系统导论	86000442	2	m	**M**	m	m	**M**	m	m	**M**	m		
Traffic Modeling and Simulation 交通建模与仿真	86000402	2	m	**M**	m	m	**M**	m	m	**M**	m		
Hybrid System Design for Smart City 智慧城市混合系统设计	86000482	2	m	**M**	m	**M**	**M**	**M**	m	**M**	m		
Introduction to Nonlinear Optimization 非线性优化概述	86000461	1	m	**M**	m	**M**	**M**	**M**	m	**M**	m		
Introduction to Quantitative Investment 量化投资概论	76000082	2	m	**M**	m	m	**M**	m	m	**M**	m		
Optimization Theory and Machine Learning 优化理论和机器学习	86000611	1	m	**M**	m	**M**	**M**	**M**	m	**M**	m		

Compressive Sensing with Sparse Models: Theory, Algorithms, and Applications 压缩感知与稀疏模型：理论、算法与应用	86000621	1	m	**M**	m	**M**	**M**	**M**	m	**M**	m		
Track Three：			**D1T1:**	**D1T2：**	**D1T3：**	**D2T1:**	**D2T2：**	**D2T3：**	**D3T1:**	**D3T2：**	**D3T3：**		
Design of Precision Medicine Platforms for Disease Diagnosis and Therapeutics 精准医疗平台的设计及其疾病诊断和治疗应用		1	m	m	**M**	m	m	**M**	**M**	**M**	**M**		
Translational Research(C)转化研究（C）	86000221	1	m	m	**M**	m	m	**M**	m	m	**M**		
Introduction to Mechanobiology 机械生物学介绍	86000542	2	m	m	**M**	m	m	m	**M**	**M**	**M**		
Technology Advances for Regenerative Medicine 再生医学技术进展	86000553	3	m	m	**M**	m	m	m	**M**	**M**	**M**		
Introduction to Microfluidics 微流控技术简介		1	m	m	**M**	m	m	**M**	**M**	**M**	**M**		
Biophotonics for Engineers 生物光子学方法与实践	86000333	3	**M**	m	**M**	**M**	m	m	**M**	**M**	**M**		
Introduction to Computer-Aided Tissue Engineering 计算机辅助组织工程	86000202	2	m	m	**M**	m	m	**M**	**M**	**M**	**M**		
Translational Research (B)转化研究（B）	86000211	1	m	m	**M**	m	m	**M**	**M**	**M**	**M**		

Introduction to Advanced Medical Device Design and Fabrication 高端医疗器械设计及制造概论	86000341	1	m	m	**M**	m	m	**M**	**M**	**M**	**M**		
Tissue Engineering 组织工程	86000231	1	m	m	**M**	m	m	**M**	**M**	**M**	**M**		
Soft Material Module 1: Biological Soft Materials 软质材料模块 1：生物软质材料	86000261	1	m	m	**M**	m	m	**M**	**M**	**M**	**M**		
Soft Material Module 2: Synthetic and Hybrid Soft Materials 软质材料模块 2: 合成、混合软材料	86000271	1	m	m	**M**	m	m	**M**	**M**	**M**	**M**		
Soft Material Module 3: Fabrication of Biomaterials 软质材料模块 3：生物材料制造工程	86000281	1	m	m	**M**	m	m	**M**	**M**	**M**	**M**		
Vision and Imaging Science 视觉及影像科学	86000351	1	m	m	**M**	m	m	**M**	**M**	**M**	**M**		
Current Topics in Cancer Biology 癌症生物学的研究现状	86000673	3	m	m	**M**	m	m	**M**	**M**	**M**	**M**		