广东以色列理工学院材料科学与工程专业人才培养方案

（专业代码：080401H）

一、 概述

本专业以物理、化学和工程学为基础，旨在让学生了解加工和构成如何影响材料的结构、性质和性能，是多学科知识与技能的交叉融合。专业课程涵盖了晶体结构和微观结构分析、材料加工、电化学、扩散和相变、动力学和热力学、高分子性质等内容，旨在培养能够整合与领导材料研发及在半导体制造、生物材料等高科技产业应用的优秀工程师和科技人才。

二、培养目标

学生将参与多项与产业界合作的研发项目，掌握材料科学与工程的先进研究方法。本专业毕业生可从事学术研究（以研究生深造的方式）或在相关行业就业。材料工程师可在以下应用领域的行业及开发中心求职： 电子和通信；航空航天或飞行器制造；核电行业；高分子纳米复合材料及塑料材料；以及制药和生物材料。

三、毕业学分要求

四年制本科专业总学分为 160 学分，含 2 个学分的体育课。学生还需修满教育部规定的思想政治理论课程学分，并达到考核合格标准。教学既包括理论教学，也包括实践教学。

四、修业年限

四年，授予广东以色列理工学院材料科学与工程专业工学学士学位，以色列理工学院 Materials Engineering 学士学位。

五、人才培养基本要求

1. 掌握本专业工作所要求的数学、自然科学知识、工程技术知识以及一定的经济学与管理学知识。
2. 系统掌握材料科学与工程学科的基本理论和知识；熟悉材料组成、结构、合成/生产与性能之间关系的基本原理。
3. 掌握本学科涉及的各种材料的制备、性能测试和分析的基本知识和技能。
4. 了解材料相关学科的发展现状和趋势；有创新意识；具有提高材料性能和产品质量，开发和研究新材料和新工艺，根据工程项目选择和使用材料等基本能力。

5. 培养创新和创业的技能。
6. 具有终身学习的意识；能够运用现代信息技术获取相关信息、新技术、新知识，不断提高个人能力。
7. 具有全球视野，高水平的外语能力，跨文化交际能力和合作能力。

六、毕业要求

本专业学生在规定年限内完成教学计划要求，取得不少于规定的 160 学分（包括专业核心课程 126 学分，专业选修课程 24 学分以及通识选修课程 10 学分），并且每门课程达到 55 分以上，GPA 达 65 分以上，满足教育部规定的思想政治理论课的学分要求，可经审核准予毕业。

七、基本信息资源

以手册、网站等形式，提供本专业的培养方案、教学大纲、教学标准、课程评价标准、毕业审核标准等基本教学信息。

八、教材及参考书

选用反映国际水平的外文版教材，有利于稳妥地开展双语或全外语教学。

材料科学与工程专业课程目录 [1]

专业必修课	126 分
专业选修课	24 分
通识选修课	10 分
总分	**160 分**

课程代码	课程名称 （专业核心课程）	学分
第一学期		
01040041	微积分 1M	5
01040019	线性代数 M	4.5
01140051	物理学 1	2.5
01240117	基础化学 A	3
02340128	Python 计算机入门	4
03240033	专业英语 B	3
	总学分	**22**
第二学期		
01040043	微积分 2 M	5
01040131	常微分方程/H	2.5
01140052	物理学 2	3.5
01240118	基础化学 B	3
03140011	工程材料结构与性能	4
03940800	体育	1
	总学分	**19**
第三学期		
00940481	概率论与数理统计导论	4
01040228	偏微分方程 M	3
01140081	物理实验 1	1.5
01240400	量子化学（一）	5
03140009	工程材料实验	1.5
	总学分	**15**
第四学期		
01250801	有机化学	2.5
01240413	统计热力学	2.5
01240414	物理化学-化学反应动力学	2.5
03140009	工程材料实验 N	1.5
03140003	固体力学导论	2.5
03150003	材料热力学	4

1.开设课程与学期根据以色列理工学院教学计划与实际教学安排可能进行动态调整。

03150051	固态扩散	2.5
03940800	体育	1
	总学分	**19**
第五学期		
03140006	材料的显微结构表征	4
03140150	固态物理	3.5
03140312	聚合物材料导论	2.5
03140532	电化学、腐蚀与防腐蚀	2.5
03150052	相变动力学	2.5
03150242	复合材料工程	2.5
	总学分	**17.5**
第六学期		
03140016	计算机辅助材料工程图形	2.5
03140311	陶瓷与耐火材料	2.5
03150008	材料力学	3.5
03150030	电子材料	2.5
03150039	动量、热与物质传送	4
03150058	计算机分析方法	2
	总学分	**17**
第七学期		
03140309	材料加工	2.5
03150001	高级材料实验 1N	2
03150012	材料选择	2.5
03150037	金属材料的性能与应用	2.5
03150059	功能材料：性能与器件	2.5
	总学分	**12**
第八学期		
03150002	高级材料实验 2N	2
03150014	材料工程高级项目（毕业设计/论文）	4
	总学分	**6**

选修课程：学生应该至少从以下两个列表课程中获得 25 学分

材料科学与工程专业选修课程列表		
课程代码	**课程名称**	**学分**
03140124	材料工程前沿课题 1	2.5
03140126	材料工程前沿课题 2：导电式原子力显微镜	2
03140306	激光材料加工	2.5
03150016	半导体器件	2.5
03150017	加工制作和电解涂层	2.5

03150018	生物材料	2
03150021	粉末冶金与技术	2.5
03150025	材料工程高级项目	3
03150027	微电子器件的可靠性	2.5
03150031	电子陶瓷	2.5
03150034	先进陶瓷制备工艺	2
03150035	材料工程项目-选修	3
03150038	微电子材料机械系统	2.5
03150040	玻璃科学导论	2
03150041	材料光学现象	2.5
03150042	纳米科学与技术导论	2
03150044	光学材料	2.5
03150045	微电子工艺加工	3.5
03150046	超大规模集成电路器件的封装	2
03150048	生物矿化和生物材料	2
03150050	聚合物粘合剂和接头的科学与工程	2.5
03150053	用于药物输送的高分子生物材料工程	2.5
03150054	故障分析及其预防	2
03150056	晶体生长	2.5
03150057	计算材料学/计算材料科学导论	2.5
03150721	聚合物结构与性能	2.5
03160240	晶体学基础	2
03160541	导电原子力显微镜	2
03170531	计算机在材料工程中的应用	2
03170627	微电子器件的触点和金属化	2
03160243	中子和同步加速器测量仪器	2
03160244	薄膜的磁性	2
03180221	表面分析	2
03180222	离子辅助表面分析	2
03180235	塑料型变理论	2
03180527	衍射的动力学理论	2

其他院系专业选修课程列表		
课程代码	**课程名称**	**学分**
00540131	化学与生物化学工程概论	4
00540369	高分子材料工程实验室	2.5
00560391	基于纳米（生物）材料的传感器	2.5
01240122	化学原理实验室	1
01240416	电磁学和物质	2.5

01240417	物理化学-分子光谱学	3.5
01250101	工程分析化学 1	1.5
01250102	化学工程分析化学实验课 1	2
01270437	光催化	2
01270438	对称性及其在化学中的应用	4
01340058	生物学 1	3
08580121	聚合物流变学	2

具体思政课程要求如下表：

序号	课程名称	学分
1	马克思主义基本原理	3
2	毛泽东思想和中国特色社会主义理论体系概论	3
3	中国近现代史纲要	3
4	思想道德与法治	3
5	习近平新时代中国特色社会主义思想概论	3
6	形势与政策	2
7	走在前列的广东实践	1
8	大学生国家安全教育	1
	总分	**19**
9	中华民族共同体概论（选修）	2

GTIIT Cultivation Scheme of Materials Science and Engineering Program

1. Overview

Based on physics, chemistry and engineering, the program aims to let students understand how processing and composition affect the structure, properties and performance of materials, and is a combination of multidisciplinary knowledge and skills. Specialized courses cover crystal structure and microstructure analysis, materials processing, electrochemistry, diffusion and phase transitions, kinetics and thermodynamics, and polymer properties, aiming to produce outstanding engineers and technologists who can integrate and lead materials research and development and its application in high-tech industries such as semiconductor manufacturing and biomaterials.

2. Cultivation Goal

Students will participate in R&D projects many of which are in cooperation with the industry, and master advanced research methods of materials science and engineering. Graduates of the program can be engaged in academic research (mainly by advancing to graduate studies) or get employed in relevant industries. Material engineers may seek employment in industries and development centers of the following applications: electronics and communication; aerospace or vehicle manufacturing; nuclear industry; polymer nanocomposites and plastic materials; and in pharmaceuticals and biomaterials.

3. Total Credits for Graduation

The total credits of the four-year undergraduate program are 160, including 2 credits of physical education courses. Students are also required to complete the credits in ideological and political theory courses as stipulated by the Ministry of Education of China (MOE) and meet the passing assessment standards. The teaching includes theoretical teaching as well as practical teaching.

4. Study Years

4 years, students will be awarded the bachelor's degree of Engineering in Materials Science and Engineering of GTIIT, and the bachelor's degree of Science in Materials Engineering from the Technion.

5. Basic Requirements for Talents Cultivation

a. Master the knowledge of mathematics and natural science, the knowledge of engineering technology, and certain knowledge of economics and management required by the professions in this program field.

b. Systematically master the basic theories and knowledge of the materials science and engineering discipline; familiar with the basic principles of the relationship between materials' composition, structure, synthesis/production and properties.
c. Master the basic knowledge and skills of preparation, performance testing and analysis of various materials involved in the discipline.
d. Understand the development status and trends of related disciplines in materials; have a sense of innovation; have basic abilities to improve materials performance and product quality, to develop and study new materials and new crafts, to select and use materials according to engineering projects, etc.
e. Develop the skill of innovation and entrepreneurship.
f. Have a sense of lifelong learning; able to use modern information technology to acquire related information, new technologies, and new knowledge to constantly improve personal abilities.
g. Have a global vision, high-level foreign language proficiency, intercultural communications ability and cooperation ability.

6. Graduation Requirements

Students will graduate when fulfilling the graduation requirements within the prescribed number of years, and have at least 160 credits of the described structure of core (126 credits), program elective (24 credits) and general e courses (10 credits), with a minimum grade of 55 in each course, and GPA above 65. Fulfilling the requirement of MOE ideological and political theory courses, students may be approved for graduation upon review.

7. Basic Information Resources

The program cultivation schemes, syllabi, teaching criteria, assessment criteria of courses, graduation evaluation criteria and other basic teaching information are offered in form of brochures, websites, etc.

8. Textbooks and References

Foreign language textbooks that reflect the international level are selected for steady practices of bilingual or fully English-medium instruction.

Materials Science and Engineering Program Curriculum[2]

Compulsory Courses	125	points
Program Elective Courses	25	points
General Elective Courses	10	points
TOTAL	**160**	**points**

Course Code	Course Name (Program Core Course)	Credits
Semester 1		
01040041	Differential and Integral Calculus 1M	5
01040019	Linear Algebra M	4.5
01140051	Physics 1	2.5
01240117	Principles of Chemistry A	3
02340128	Introduction to Computing with Python	4
03240033	Technical English - Advanced B	3
	Total	**22**
Semester 2		
01040043	Differential and Integral Calculus 2 M	5
01040131	Ordinary Differential Equations/H	2.5
01140052	Physics 2	3.5
01240118	Principles of Chemistry B	3
03140011	Structure and Properties of Engineering Materials	4
03940800	Physical Education Courses	1
	Total	**19**
Semester 3		
00940481	Introduction to Probability and Statistics	4
01040228	Partial Differential Equations/M	3
01140081	Physics Lab. 1	1.5
01240400	Quantum Chemistry 1	5
03140009	Engineering Materials Laboratory N	1.5
	Total	**15**
Semester 4		
01250801	Statistical Thermodynamics	2.5
01240413	Physical Chemistry - Chemical Kinetics	2.5
01240414	Organic Chemistry 1b*	2.5
03140009	Introduction to Solid Mechanics	1.5
03140003	Thermodynamics of Materials	2.5
03150003	Diffusion in Solids	4

2. Course offerings and scheduling may be properly adjusted in accordance with the Technion's academic plan and actual teaching arrangements.

03150051	Physical Education Courses	2.5
03940800	Statistical Thermodynamics	1
	Total	**19**
Semester 5		
03140006	Microstructural Characterization of Materials	4
03140150	Solid State Physics	3.5
03140312	Introduction to Polymeric Materials	2.5
03140532	Electrochemistry, Corrosion & Corrosion Protection	2.5
03150052	Kinetics of Phase Transformations	2.5
03150242	Composite Materials Engineering	2.5
	Total	**17.5**
Semester 6		
03140016	Computer-aided Material Eng. Graphic	2.5
03140311	Ceramics and Refractories	2.5
03150008	Mechanical Behavior of Materials	3.5
03150030	Properties of Electronic Materials	2.5
03150039	Momentum, Heat and Mass Transport	4
03150058	Computer Analysis Methods	2
	Total	**17**
Semester 7		
03140309	Materials Processing	2.5
03150001	Advanced Materials Laboratory 1N	2
03150012	Materials Selection	2.5
03150037	Properties and Applications of Metals	2.5
03150059	Functional Materials - Properties & Devices	2.5
	Total	**12**
Semester 8		
03150002	Advanced Materials Laboratory 2N	2
03150014	Advanced Project in Materials Engineering	4
	Total	**6**

The student should acquire at least 25 points taking elective courses from the two lists given below:

Electives Courses from Materials Science and Engineering Department		
Course Code	**Course Name**	**Credits**
03140124	Advanced Topics in Materials Engineering 1	2.5
03140126	Advanced Topics in Materials Engineering 2 - Conductive Atomic Force Microscopy	2
03140306	Laser Material Processes	2.5

03150016	Semiconductor Devices for Materials Engineering	2.5
03150017	Finishing Processes and Electrolytic Coating	2.5
03150018	Biomaterials	2
03150021	Powder Metallurgy and Technology	2.5
03150025	Advanced Project in Materials Engineering 2	3
03150027	Reliability of Microelectronic Devices	2.5
03150031	Electronic Ceramics	2.5
03150034	Processing of Advanced Ceramics	2
03150035	Materials Engineering Project - Optional	3
03150038	Materials for Micro-Electro-Mechanical-Systems	2.5
03150040	Introduction to Glass Science	2
03150041	Optical Phenomena in Materials	2.5
03150042	Introduction to Nanoscience and Nanotechnology	2
03150044	Optical Materials	2.5
03150045	Processes in Microelectronics Fabrication	3.5
03150046	Packaging of VLSI Devices	2
03150048	Biomineralization and Biological Materials	2
03150050	The Science and Engineering of Polymers Adhesives and Joints	2.5
03150053	Engineering of Polymeric Biomaterials for Drug Delivery	2.5
03150054	Failure Analysis and its Prevention	2
03150056	Crystal Growth	2.5
03150057	Computational Materials Science	2.5
03150721	Fracture and Behavior of Polymers	2.5
03160240	Basics of Crystallography	2
03160541	Conductive Atomic Force Microscopy	2
03170531	Computer Applications in Materials Engineering	2
03170627	Contacts and Metallization for Microelectronic Devices	2
03160243	Neutron and Synchrotron Instrumentation	2
03160244	Magnetic Properties of Thin Films	2
03180221	Surface Analysis	2
03180222	Ion Assisted Surface Analysis	2
03180235	The Theory of Plastic Deformation	2
03180527	The Dynamical Theory of Diffraction	2

Electives Courses from Other Departments		
Course Code	**Course Name**	**Credits**
00540131	Introduction to Chemical and Biochemical Engineering	4

00540369	Polymer Engineering Laboratory	2.5
00560391	Sensors based on Nano (Bio) Materials	2.5
01240122	Laboratory in Principles of Chemistry	1
01240416	Electromagnetism and Matter	2.5
01240417	Physical Chemistry -Molecular Spectroscopy	3.5
01250101	Analytical Chemistry 1 for Engineers	1.5
01250102	Analytical Chemistry Laboratory1 For Engineers	2
01270437	Photocatalysis	2
01270438	Symmetry and its Applications in Chemistry	4
01340058	Biology 1	3
08580121	Polymer Rheology	2

The specific MOE courses are listed below:

No.	Course Name	Credit
1	Basic Principles of Marxism	3
2	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics	3
3	An Outline of Modern and Contemporary Chinese History	3
4	Ideological and Moral Cultivation and the Rule of Law	3
5	An Introduction to Xi Jinping's Thought of Socialism with Chinese Characteristics in the New Era	3
6	Situation and Policy	2
7	Guangdong's Pioneering Practices	1
8	National Security Education	1
	Total	**19**
9	Introduction to the Chinese National Community (Elective)	2