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# 本科培养方案



# 沈阳化工大学简介

沈阳化工大学是一所以工为主、以化工为特色，工、理、管、经、文、法、医等7大学科门类相结合的多科性综合大学，是辽宁省“双一流”重点建设高校、国家“中西部高校基础能力建设工程”重点建设高校（“小211”）、教育部卓越工程师教育培养计划高校、全国深化创新创业教育改革示范高校、国家级“大学生创新创业训练计划”入选高校、全国社会工作示范单位、国家级社会工作专业人才培养基地。

学校现设有学院（部）16个，招生本科专业47个。其中，国家一流专业建设点13个、通过国家工程教育专业认证14个、教育部高等学校特色专业建设点4个、教育部“卓越工程师教育培养计划”试点专业2个、国家级综合改革试点专业2个，省级一流示范专业34个、省级综合改革试点专业5个、省级工程人才培养模式改革试点专业4个、省级创新创业教育改革试点专业5个、省级本科优势特色专业1个、省级课程体系国际化试点专业1个、省级示范性专业（特色专业）6个、省级紧缺人才培养基地1个、向应用型转变示范专业7个。

现有教职工中入选全球前2%顶尖科学家3人；外籍院士、中科院“百人计划”入选者，教育部“长江学者奖励计划”教授，国家高层次人才等腾飞学者6人，振兴学者4人；享受国务院政府特殊津贴专家25人；国家教学名师、全国模范教师、全国优秀教师、宝钢优秀教师、教育部（省）专业教学指导委员会委员等30余人次；省优秀专家、省攀登学者、省领军人才、省特聘教授、省“兴辽英才计划”、省“百千万”人才等130余人次；全国石油和化工行业教学名师、省教学名师、省优秀教师等90余人次；首批全国高校黄大年式教师团队，全国石油和化工行业优秀教师团队、省高等学校创新团队和教学团队15个。

学校全面贯彻党的教育方针，围绕立德树人根本任务，大力落实“三全育人”“五育并举”，建立“113”人才培养体系，推进科教融合、产教协同，培养高素质应用型创新人才。拥有国家级实验教学示范中心2个、国家级工程实践教育中心1个，省级各类教育教学平台34个。获得国家级教学成果奖二等奖2项、省级教学成果奖66项。在全国“挑战杯”、化工设计等大赛中获国家奖60余项，多次被教育部、团中央授予全国“挑战杯”高校优秀组织奖，获评“全国大学生暑期三下乡社会实践活动优秀组织单位”。

学校入选全国应急管理学院建设首批试点学校，面向社会培养化工安全类人才；建设的菱镁产业学院入选国家首批现代产业学院，推动辽宁“原字号”菱镁产业高质量升级发展；与中国科学院共建“科教融合学院”，联合培养研究生和本科生。

学校坚持社会主义办学方向，坚持为党育人、为国育才使命，履行“四个服务”的时代使命，着力培养担当民族复兴大任的时代新人，以高水平党建引领、推动和保证学校高质量发展。站在新的历史起点，沈阳化工大学秉持“艰苦奋斗、知难而进、追求卓越、守正创新”的新时代化大精神，统筹推进“四位一体”的总体布局和“三步走”的战略布局，为走出内涵式创新型特色化办学之路，为实现腾飞之梦、强校之梦、名校之梦，为把学校建设成为区域闻名全国著名国际知名的高水平教学研究型大学而努力奋斗！



# 沈阳化工大学本科专业设置

序号	专业名称	学科门类	类别	专业代码	所在学院
1	化学工程与工艺	工学	化工与制药类	081301	化学工程学院
2	化学工程与工艺（优创班）	工学	化工与制药类	081301	化学工程学院
3	化学工程与工艺（卓越班）	工学	化工与制药类	081301	化学工程学院
4	资源循环科学与工程	工学	化工与制药类	081303T	化学工程学院
5	能源化学工程	工学	化工与制药类	081304T	化学工程学院
6	林产化工	工学	林业工程类	082403	化学工程学院
7	应用化学	工学	化学类	070302	化学工程学院
8	化学工程与工艺（专升本）	工学	化工与制药类	081301	化学工程学院
9	材料化学	工学	材料类	080403	材料科学与工程学院
10	无机非金属材料工程	工学	材料类	080406	材料科学与工程学院
11	高分子材料与工程	工学	材料类	080407	材料科学与工程学院
12	高分子材料与工程（优创班）	工学	材料类	080407	材料科学与工程学院
13	高分子材料与工程（卓越班）	工学	材料类	080407	材料科学与工程学院
14	复合材料与工程	工学	材料类	080408	材料科学与工程学院
15	包装工程	工学	轻工类	081702	材料科学与工程学院
16	机械设计制造及自动化	工学	机械类	080202	机械与动力工程学院
17	机械电子工程	工学	机械类	080204	机械与动力工程学院
18	金属材料工程	工学	材料类	080405	机械与动力工程学院
19	过程装备与控制工程	工学	机械类	080206	机械与动力工程学院
20	能源与动力工程	工学	能源动力类	080501	机械与动力工程学院
21	能源与动力工程（中外合作办学）	工学	能源动力类	080501	机械与动力工程学院
22	油气储运工程	工学	矿业类	081504	机械与动力工程学院
23	机械设计制造及自动化（专升本）	工学	机械类	080202	机械与动力工程学院
24	测控技术与仪器	工学	仪器类	080301	信息工程学院
25	电气工程及其自动化	工学	电气类	080601	信息工程学院
26	电子信息工程	工学	电子信息类	080701	信息工程学院
27	电子科学与技术	工学	电子信息类	080702	信息工程学院
28	人工智能	工学	电子信息类	080717T	信息工程学院
29	自动化	工学	自动化类	080801	信息工程学院

序号	专业名称	学科门类	类别	专业代码	所在学院
30	物联网工程	工学	计算机类	080905	信息工程学院
31	电气工程及其自动化（专升本）	工学	电气类	080601	信息工程学院
32	自动化（专升本）	工学	自动化类	080801	信息工程学院
33	计算机科学与技术	工学	计算机类	080901	计算机科学与技术学院
34	软件工程	工学	计算机类	080902	计算机科学与技术学院
35	网络工程	工学	计算机类	080903	计算机科学与技术学院
36	数据科学与大数据技术	工学	计算机类	080910T	计算机科学与技术学院
37	计算机科学与技术（专升本）	工学	计算机类	080901	计算机科学与技术学院
38	软件工程（专升本）	工学	计算机类	080902	计算机科学与技术学院
39	网络工程（专升本）	工学	计算机类	080903	计算机科学与技术学院
40	制药工程	工学	化工与制药类	081302	制药与生物工程学院
41	食品科学与工程	工学	食品科学与工程类	082701	制药与生物工程学院
42	生物工程	工学	生物工程类	083001	制药与生物工程学院
43	环境工程	工学	环境科学与工程类	082502	环境与安全工程学院
44	水质科学与技术	工学	环境科学与工程类	082507T	环境与安全工程学院
45	安全工程	工学	安全科学与工程类	082901	环境与安全工程学院
46	应用物理学	理学	物理学类	070202	理学院
47	化学	理学	化学类	070301	理学院
48	金融学	经济学	金融学	020301K	经济与管理学院
49	国际经济与贸易	经济学	经济与贸易类	020401	经济与管理学院
50	工程管理	管理学	管理科学与工程类	120103	经济与管理学院
51	大数据管理与应用	管理学	管理科学与工程类	120108T	经济与管理学院
52	应急管理	管理学	管理科学与工程类	120111T	经济与管理学院
53	工商管理	管理学	工商管理类	120201K	经济与管理学院
54	会计学	管理学	工商管理类	120203K	经济与管理学院
55	英语	文学	外国语言文学类	050201	外国语学院
56	国际经济与贸易（俄语方向）	经济学	经济与贸易类	020401	外国语学院
57	社会工作	法学	社会学类	030302	人文与艺术科学学院
58	环境设计	艺术学	设计学类	130503	人文与艺术科学学院
59	产品设计	艺术学	设计学类	130504	人文与艺术科学学院

# 沈阳化工大学关于制（修）订 2021 版 本科专业人才培养方案的指导性意见

化大发〔2021〕14 号

培养方案体现了学校人才培养的指导思想，是专业对人才培养目标、毕业要求、课程设置和教学模式的总体设计，是人才培养的基本“蓝图”，是实现人才培养目标、保证人才培养质量的基础性文件，也是学生进行学习规划、学校进行教学组织与管理、院（部）进行课程和资源建设规划的主要依据。2016 年，学校依据《沈阳化工大学关于加快高水平教学研究型大学建设步伐的若干意见》，确立了把我校建设成为具有鲜明化工特色和应用特色的省属一流、全国著名的教学研究型大学的目标定位。构建符合社会需求、适合我校办学定位、具有我校办学特色的“113”人才培养体系，并在 11 个专业实施，取得了丰硕成果，提高了人才培养质量。2018 年，学校制（修）订 2018 版本科人才培养方案，符合学校整体专业发展要求。为了进一步贯彻全国教育大会和新时代全国高等学校本科教育工作会议精神，全面落实《教育部关于深化本科教育教学改革全面提高人才培养质量的意见》（教高〔2019〕6 号）、《教育部关于加快建设高水平本科教育全面提高人才培养能力的意见》（教高〔2018〕2 号）、教育部关于印发《高等学校课程思政建设指导纲要》（教高〔2020〕3 号）和《沈阳化工大学“十四五”事业发展规划编制工作方案》等文件要求，创新人才培养模式，全面提高人才培养质量，打造具有自身特色的一流本科教育和一流人才培养体系，学校决定全面启动 2021 版本科人才培养方案修订工作，并提出以下指导性意见。

## 一、指导思想

新一轮培养方案的制（修）订要全面贯彻党的教育方针，坚持社会主义办学方向，以习近平新时代中国特色社会主义思想为指导，坚持“以本为本”“四个回归”，以“立德树人”为根本任务，构建一流人才培养体系。遵循高等教育教学及大学生身心发展的基本规律，主动适应知识经济时代社会发展、建设创新型国家和人才强国战略对人才培养的新要求，落实国家人才培养总目标，落实学校人才培养总体目标，培养具有优秀的思想品德和高尚的职业道德，坚实的专业知识，突出的实践能力和强烈的创新创业意识，出色的沟通能力和优秀的团队精神，成为品德高尚、专业过硬、情商出众、强于实践、勇于创新的高素质应用型人才。培养德智体美劳全面发展的社会主义建设者和接班人。

## 二、基本原则

在新一轮的本科人才培养方案制订与实施中，把握好坚持立德树人、坚持需求导向、突出特色优势、鼓励分类培养和深化教学改革的总体原则，重点关注对接本科专业类教学质量国家标准、专业认证标准中的要求，充分进行调研、论证，形成保证人才培养目标达成的能力素质要求，制定明确的、科学的课程思政改革、体育教育、美育教育、劳动教育、创新创业教育和实践能力提升的具体实施方案。把本科人才培养方案修订工作与打造一流课程、建设一流专业、培育一流人才结合起来。充分审视各专业培养方案与经济社会发展和学生发展需求的契合度、课程设置对培养目标和毕业要求的支撑度。构建“以学生发展为中心”的本科人才培养体系，实现培养理念、培养定位、培养方案、培养模式的有机统一。

## 三、基本要求

### **（一）坚持党的教育方针，遵循高等教育和人才成长规律**

认真贯彻党和国家的教育方针，坚持立德树人的根本任务，以区域经济社会发展和学生全面成长需求为导向，结合学校办学定位和人才培养目标，按照高等教育规律和人才成长规律的要求理顺通识教育与专业教育、人文教育与科学教育、理论教学与实践教学、共性要求与个性培养等关系，优化本科专业的知识结构和课程体系，改革教学内容，突出专业特色，强化创新精神和实践能力培养，为国家和区域经济社会发展，培养德智体美劳全面发展的高素质应用型人才。

### **（二）进一步推进“113”人才培养体系改革**

培养方案的制（修）订要反映学校办学指导思想，符合学校的整体定位和人才培养目标。坚持“育人为根本，质量是生命”的宗旨，坚持“加强基础、重视实践、培养能力”的原则，体现“113”人才培养体系改革和创新精神，将我校近年来的学科建设和教学改革系列成果转化为优质教育资源，固化在培养方案中。培养方案的制（修）订体现学校的办学特色，具有科学性、先进性、规范性、稳定性和可行性。

### **（三）坚持成果导向教育理念，实施分类修订**

培养方案的制（修）订要遵循教育部高等学校教学指导委员会制定的《普通高等学校本科专业类教学质量国家标准》，以国际先进的成果导向教育理念为核心，以 CDIO 人才培养模式为重点，以“协同化育人、家庭化培养、个性化指导”的“三化”育人为举措，大力推进人才培养供给侧改革，突出项目式教学要求，进一步提升人才培养与区域经济社会发展的适应度。结合“六卓越一拔尖”2.0 计划、“四新”专业、国际一流、国家一流、省级一流等建设要求，结合学校办学定位，准确定位专业发展目标，确定人才培养目标，进而确定毕业要求。毕业要求对学生相关能力的描述，能体现对专业培养目标定位和特色的支撑。

### **（四）进一步优化课程体系，确保支撑全部毕业要求**

由毕业要求设计课程体系，保证内外需求与培养目标、培养目标与毕业要求、毕业要求与课程体系及教学内容之间具有良好的对应关系。以毕业要求为依据，确定课程体系结构，设计课程内容、教学方法和考核方式。优化学时学分，调整课程结构，注重课内与课外、校内与校外的教学活动的有机融合，形成融会贯通、紧密结合、有机联系的课程体系。明确课程的先修后续关系，重点解决课程内容冗余；明确各课程对培养目标达成的作用，确保课程体系能够支撑毕业要求的达成。

### **（五）坚持“8 注重 8 强化”，培养高素质人才**

#### **1.注重思想品德，强化德育教育**

深入贯彻落实党的十九大精神、全国高校思想政治工作会议精神、全国教育大会精神，全面落实《教育部等八部门关于加快构建高校思想政治工作体系的意见》（教思政〔2020〕1 号）和《高等学校课程思政建设指导纲要》（教高〔2020〕3 号）等文件要求，突出立德树人，把思想政治工作贯穿教育教学全过程，强化对学生的价值引领和三观塑造。推进“思政课程”与“课程思政”改革，建立课程、专业和学科思政教学体系。强化“课程思政”“专业思政”，把思想政治教育有机融入课程大纲中，形成专业课教学与思政课教学同向同行，协同育人。

#### **2.注重品质教育，强化劳动育人**

为全面落实《中共中央国务院关于全面加强新时代大中小学劳动教育的意见》文件要求，以课程教育为主要依托，以实践育人为基本途径，加强劳动教育，促进学生身心健康，把劳动教育融入专业教育体系和课程大纲体系。课程内容要注重将专业特点与产业新业态、劳动新形态相结合，可围绕实习实训、专业

服务、社会实践、创新创业、勤工助学等开展，使学生增强诚实劳动意识，树立正确择业观，在劳动中力行，在力行中励志。让学生动手实践、出力流汗，接受锻炼、磨炼意志，培养学生正确劳动价值观和良好劳动品质，在学生中弘扬劳动精神，教育引导学生崇尚劳动、尊重劳动，引导学生形成马克思主义劳动观。

### **3.注重审美教育，强化美育精神**

为全面落实《教育部关于切实加强新时代高等学校美育工作的意见》（教体艺〔2019〕2号）文件要求，完善课程教学、实践活动、校园文化、艺术展演“四位一体”的普及艺术教育推进机制。全面深化美育教学改革与创新，把公共艺术课程与艺术实践纳入人才培养方案。推进美育引领学生树立正确的审美观念、陶冶高尚的道德情操、塑造美好心灵，遵循美育特点，弘扬中华美育精神，以美育人、以美化人、以美培元。

### **4.注重体育教育，强化身心健康**

为贯彻落实习近平总书记关于教育、体育的重要论述和全国教育大会精神，把学校体育工作摆在更加突出位置，学生体质健康达标、修满体育学分方可毕业，构建德智体美劳全面培养的教育体系。充分发挥体育教育强健身心、健全人格、培育智慧和培养规则意识的功能。树立“健康第一”的教育理念，推动文化学习和体育锻炼协调发展，促进学生在体育锻炼中享受乐趣、增强体质、健全人格、锤炼意志。

### **5.注重能力培养，强化实践育人**

充分利用校内外实践教学资源，系统设计实践育人教育教学体系，结合专业特点和人才培养要求，分类制订实践教学标准。增加实践教学比重，丰富实践教学内容、方式和途径，形成基础层、综合层、研究与创新层组成的多层次、立体化、开放式的实践体系，构建更加完善的实践教学体系，提升工科学生的工程实践能力。加强现代信息技术、虚拟仿真技术在实践教学中的应用，鼓励开发相关虚拟仿真项目和虚拟仿真课程，并有效落实在方案中。

### **6.注重创新创业，强化“双创”教育**

把创新创业教育融入人才培养全过程，注重学生创新创业意识、思维和能力培养。积极开设创新创业通识课程和具备学科专业特色的创新创业课程，把创新创业教育理念有机融入课程大纲中，把学生课外科技创新、学科竞赛、创业训练及社会实践等活动纳入毕业学分，形成依次递进、有机衔接的创新创业教育课程体系。推进“创新课程”与“课程创新”改革，建立课程、专业和学科创新的教学体系。强化“课程创新”“专业创新”，把创新创业教育有机融入课程大纲中，形成专业课教学与创新创业教学同向同行，协同育人。

### **7.注重学以致用，强化协同育人**

进一步加强协同育人，全面推进科教、产教融合。以“科教融合、产教融合”为主要路径，深化开放合作，推进校地、校企、校校、校研和国际合作育人。以实施“卓越工程师教育培养计划”和“工程教育专业认证”为抓手，深化产教融合，积极寻求行业企业与我校合作培养人才，走产学研合作培养人才之路，让行业企业深度参与专业人才培养方案的制定，推动教学紧贴生产实际和技术进步。结合重大、重点科技计划任务，建立科教融合、相互促进的协同培养机制。以高水平科学研究支撑高质量人才培养，统筹协调理论教学、实践教学、创新创业教育、社会责任教育的关系，充分发挥院（部）的主体作用以及部门的指导和服务作用，全面推进协同育人、共同建设课程体系和教学内容，共同实施培养过程，共同评价培养质量，变校内培养为开放式的合作培养。

### **8.注重个性发展，强化因材施教**

坚持以学生成长为中心的理念，重视学生个性化需求，提高学生自主选择空间，结合专业特点和学生

实际情况，开展分层次、分类型、分方向培养；积极推进卓越人才培养计划、校企合作办学、中外合作办学专业教学改革，突出专业核心能力培养，彰显专业办学特色，构建多元化人才培养模式。

#### 四、基本框架

##### （一）主要内容

本科专业培养方案和指导性教学计划的主要内容要满足《普通高等学校本科专业类教学质量国家标准》。培养方案样例见。

##### （二）培养目标

专业培养目标要根据学校人才培养的目标定位，在对本专业的社会需求状况、专业的学科支撑情况等进行深入调研和论证的基础上，参考专业教学指导委员会制定的专业人才培养规范制定，或者在科学的培养目标合理性评价的基础上进行修订。专业培养目标要描述精准，明确本专业毕业生就业领域与性质以及社会竞争优势。

##### （三）毕业要求和毕业要求支撑培养目标实现的关系矩阵

毕业要求是对学生毕业时所应该掌握的知识能力的具体描述，包括学生通过本专业学习所掌握的技能、知识和能力。各专业根据本专业特色分条梳理出能支撑培养目标的可实现、可衡量、可评价的具体培养要求。工科专业毕业要求须涵盖如下2个部分（技术因素和非技术因素）、3个方面（专业能力、专业素养、发展能力）的12条内容。文科、理科等其他专业的毕业要求也应涵盖以上3个方面，其中的12条内容可根据专业实际情况酌情调整。本次方案修订将立德树人要求纳入毕业能力要求并进行指标点分解。

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。样例见培养方案样例第十三部分。

##### （四）课程修读与学分要求

四年制本科专业总学分控制在170学分左右。学分计算办法：理论课程16学时计1学分；实验课程、上机等24学时计1学分；体育课教学36学时计1学分；集中实践环节，如工程训练、实习、课程设计等，1个教学周计1学分。学分最小单位为0.5。

理工类：毕业实习与毕业设计（论文）共14学分，集中实践环节30~35周；经、管、文、法、教育、艺术类：毕业实习与毕业设计（论文）共10学分，经、管、文、法、教育、艺术类集中实践环节20~25周。列入教学计划的各实践环节累计学分（学时），经、管、文、法、教育、艺术类专业一般不应少于总学分（学时）的15~20%，理工类专业一般不应少于总学分（学时）的25%。

学生在校期间必须按照专业教学计划的规定修读课程、参加实践性教学环节、创新创业实践环节和其它教育环节，修满规定的各类学分和总学分才能毕业。教学计划在任选课总学分之内设定若干任选课组(或类型模块、特定课程)并规定每组应获的最低学分。未达该最低学分要求的视为未获满毕业所要求的规定学分。除另有规定外在一组内多获学分不能抵充另一组所缺学分。

##### （五）课程体系配置流程图

各专业应按照以能力培养为核心、以课程修读顺序为主线制定课程配置流程图，避免课程之间的逻辑顺序颠倒，以便指导学生按序进行课程修读。课程体系配置流程图样例见培养方案样例第十二部分。

##### （六）课程矩阵（课程与毕业要求的对应关系）

各专业要认真梳理所设置课程对能力培养的作用，建立每一门课程（包括实践环节等）与毕业要求的对应关系表。课程矩阵样例见培养方案样例第十三部分。

实施 CDIO 模式的专业，应建立上述毕业要求与根据 CDIO 确定的毕业要求对应关系，以便于和工程认证相衔接。

### （七）教学进程表。

## 五、课程设置

### （一）课程结构体系

培养方案的课程体系由课内、课外两个环节实现。课内环节包括：通识教育课程、学科平台课程、专业教育课程和能力拓展课程；课外环节包括通识实践及特色实践。具体如下：

**1.通识教育课程：**为学校所有专业所设置，其目标是培养学生的政治素养、人文素质、身体素质、科学思维能力和本专业所需的最基本的科学素质等，培养学生高雅情趣、高尚情操，提高文化修养。由通识教育必修课和通识教育选修课组成。通识教育必修课包括思政类、外语类、计算机类、军事安全类、劳动体育类、创新创业类、成长规划类和心理健康类课程。（计算机类课程为全校统一安排的课程，属于通识教育范畴，但各专业可根据自身需要选择开设。如不开设，则可设置其他课程，支撑毕业要求的达成。以环境工程专业为例，可在能力拓展课程模块开设《计算机在环境工程中的应用》或类似将通识教育与专业教育相结合的课程。专业根据自身毕业要求设计教学大纲，安排教学活动。）通识教育选修课包括经济管理类、美育类、科学技术类、四史、传统文化和中国与世界课程。

**2.学科平台课程：**由学科基础课程和学科实践课程组成，其目标是建立基本统一和比较宽厚的学科基础知识，培养学生扎实的理论基础与实践能力。学科基础课程包括公共基础类（工科专业细分为数学与自然科学类、工程基础类）和专业基础类课程，学科基础课是拓宽专业口径、奠定学生今后学业发展的基石，在培养方案中占有重要的地位。

**3.专业教育课程：**由专业核心课程、专业选修课程和专业实践课程组成，是各专业分别为本专业设置，最能体现专业特色的课程，其目标是培养学生的专业素质。各专业根据国家对本专业建设的要求，灵活设置专业方向课程模块，供学生修读。鼓励专业理论课程开设全英文、双语课程，获质量工程省级建设称号的专业要求开出至少 1 门采用外语教材或用外语、双语教学的课程。专业选修课程应为在专业所属学科领域内与专业课程相关的、拓展学生知识面的有关课程。专业选修课程有助于拓展学生的知识与技能，发展学生的兴趣和特长，培养学生的个性。各专业根据专业特点与需求设置学科领域课程供学生选修。

能力拓展课程由专业特色课程组成，主要开设有利于学生个性发展和成长需要的学科前沿交叉和国际视野等课程。

**4.课外实践环节：**由课外通识实践和创新创业实践组成。课外通识实践包括人文社会实践和身心健康、外语技能实践三类，旨在通过课外对社会认知与感受、身心健康训练等实践过程，提高学生适应社会能力。创新创业实践以创新创业实操为特征，包括创新训练、创新大赛和创客活动，以提高学生综合素质与创新能力为目标，突出科技训练和创新实践，组织学生参与科学研究、开发或设计工作，培养学生的创新思维、实践能力、表达能力和团队精神。

四年制专业的课程结构体系及学生要求如下表所示。

课程结构体系及学分要求

课程类别	课程模块		课程性质	学分要求	小计	
通识教育课程	通识教育必修课	思政类	必修	18	41~45	
		外语类		12		
		计算机类		2~5		
		军事安全类		2		
		劳动体育类		5		
		创新创业类		2		
		成长规划类		1~2		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	2~3 (非艺术)	≥ 10	
		中国与世界(500)		1~3		
		四史(600)		1		
		经济管理类(700)		1 (非管理)		
		科学技术类(800)		2 (非理工)		
传统文化(900)		2				
通识教育实践课	军训	实践	2	2		
学科平台课程	学科基础课程	公共基础类	必修	60~90	60~90	
		专业基础类				
	学科实践课程	—	实践			
专业教育课程	核心专业课程	—	必修	10~30	34~80	
	专业选修课程	—	选修	4~20		
	专业实践课程	—	实践	20~30		
能力拓展课程	专业特色课程	—	必修 (或实践)	4~20	4~20	
课外实践环节	课外通识实践	人文社会实践	课外实践	2	8	
		身心健康实践				
		外语技能实践		2		
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
总学分				170		



## （二）课程设置具体要求

设置的课程满足教育部《普通高等学校本科专业类教学质量国家标准》的要求，课程设置要符合相应的要求，支撑毕业要求的达成。课程学时安排合理，各类型课程学分比例适当，专业实验课程中 50%以上实验应为设计型、综合型或创新型实验。

课程设置能够支持知识、能力和素质的培养，能够清楚表明知识、能力和素质的实现方式，开设的课程与知识、能力、素质对应关系合理。

重视课程的整合和体系优化，增加选修课比重。注意课程之间内容的衔接，避免先行课程与后续课程顺序颠倒的现象。考试课原则上每学期不超过 4 门。

工科专业以强化工程实践能力、工程设计能力与工程创新能力为核心，使知识结构科学合理，课程体系与专业目标高度契合。

课程设置要有利于学生创新精神和创业能力的培养，将创新创业教育和心理健康教育有机融入到相关教学环节中。

思想政治理论课、形势与政策、健康教育、军事理论等课程按有关规定执行。为加强学生课外实践，《思想道德修养与法律基础》和《毛泽东思想和中国特色社会主义理论体系概论》分别设置 16、32 课外学时。其中《毛泽东思想和中国特色社会主义理论体系概论》分成 I、II 两学期进行，I 为 2 学分、II 为 4 学分，32 课外学时纳入 II 授课学期进行。形势与政策使用一个课程号，分 8 个学期执行，每学期 8 学时共 64 学时折合 2 学分。课程框架表见。

## （三）学分学时设置及修读要求

### 1. 学分设置

本科指导性教学计划一般按 4 年学制设置课程及分配学分。要求每学期安排学分数原则上不超过 26 个学分，周学时不超过 35 学时（含实验）。课外学时不计入学分，课外实践类学分均不计入总学分。

### 2. 学校要求必须修读的课程为

必修课程、实践课程和课外实践课程。

### 3. 专业学位课程的设立

每个专业设置学位课程，具体要求见《沈阳化工大学本科毕业生学士学位授予工作有关规定》。学位课程原则上不超过 18 门，学分不超过 55 学分。

## （四）对课程大纲要求

专业培养方案中毕业要求的达成是由各课程教学环节的有效实施来完成的，在专业培养方案顶层设计中，必须将毕业要求落实到各课程环节中去。各课程教学环节的集合要对毕业要求指标点形成完全的支撑。

在各课程教学环节的教学大纲制定时，要贯彻成果导向教育理念，课程目标必须完全覆盖顶层设计中给出的该课程与毕业要求指标点矩阵中的要求。课程目标应具体，能够结合教学内容进行过程、环节设计等指导教学活动。课程目标必须可评价，根据课程目标进行课程评价的标准与方法要体现在教学大纲中，便于教师和学生评学。

和专业培养方案相配套的教学大纲应包括（但不限于）以下基本内容：

- 1、课程简介
- 2、课程目标与毕业要求
- 3、课程内容及时分配
- 4、教学要求
- 5、课程目标与考核方式
- 6、评价标准及成绩评价方法

供参考的教学大纲案例见附件，各课程可以根据课程的实际情况制定相应的教学大纲。

## 六、组织实施

1、按照学校总体安排，教务处提出人才培养方案修订实施细则，并提供有关建议模板，负责修订工作的组织、协调、统筹以及人才培养方案的整理、汇编。

2、各教学单位应将《普通高等学校本科专业目录（2020年版）》、《普通高等学校本科专业类教学质量国家标准》、相关专业认证标准、行业最新从业标准、卓越计划培养要求和专业规范等作为重要依据，认证组织，依托行业企业专家、校友进行充分论证，研究制定各专业人才培养方案。其他教学单位开设的课程，应提前做好沟通协调工作。

3、本次修订的人才培养方案自2021级起执行。



# 信息工程学院





# 沈阳化工大学本科培养方案

## 信息工程学院

专业名称：测控技术与仪器

专业代码：080301

制 定：封岸松

审 核：孔晓光

审 定：于三三

批 准：金志浩

2021年8月

# 测控技术与仪器专业培养方案

## 一、培养目标

本专业培养综合素质良好，德、智、体、美、劳全面发展，能在流程工业等领域从事仪器仪表及智能测控系统的分析、设计、开发、运行及管理工作的德智体美劳全面发展的应用型工程技术人才和社会主义接班人。

本专业毕业生在毕业后 5 年左右：

(1) 具有熟练运用工程数理知识和测控专业知识解决流程工业等领域的仪器仪表、智能测控等工程问题的能力。

(2) 具有运用现代工具和先进技术对流程工业等领域的仪器仪表、智能测控系统进行创新性分析、设计、集成和服务的能力。

(3) 具有正确的世界观和人生观，具备有效的沟通、表达能力及项目管理能力，有良好的团队协作精神，能在工程实践中综合考虑法律、环境、社会、经济等方面因素。

(4) 具有广阔的国际视野，主动适应不断变化的国内外形势和环境，具备终生学习的能力，能够胜任不断发展的测控技术领域工作。

## 二、专业方向

智能测控方向

## 三、毕业要求

根据本专业人才培养目标以及我校测控技术与仪器专业多年的人才培养经验，从适应社会发展的需求出发，明确现阶段本专业的毕业能力要求及其指标点分解如下：

毕业能力要求	指标点
毕业要求 1: 能够应用数学、自然科学等领域的理论与方法及工程基础和测控专业知识、技能与工具，以设计项目为载体，解决流程工业等领域仪器仪表、测控等相关复杂工程问题。	1-1.综合运用数学、自然科学、工程基础和专业知识，发现与表述一般工程问题。
	1-2.经过合理的简化、推理和分析，综合应用测控专业多方面的知识，建立仪器仪表装置在全生命周期的数学模型并求解。
	1-3.掌握仪器仪表、流程工业等领域专业知识，并能够用于推演、分析仪器仪表、流程工业等领域的复杂工程问题。
	1-4.能够综合运用数学、自然科学、工程基础和专业知识，解决仪器仪表、流程工业等领域的复杂工程问题。
毕业要求 2: 能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究来分析流程工业等领域的复杂测控工程问题，以获得有效结论。	2-1.能够运用数学、自然科学和工程科学的基本原理，识别仪器仪表、流程工业等相关领域复杂工程问题中的关键环节。
	2-2.能够通过测控技术基础原理和数学模型等方法正确表达仪器仪表、流程工业等相关领域的复杂工程问题。
	2-3.能够运用工程基础和专业知识，通过文献研究来分析仪器仪表、流程工业等相关领域的复杂工程问题，并获得有效结论。
毕业要求 3: 能够针对仪器仪表、智能检测与控制等	3-1.了解影响仪器仪表、流程工业等领域工程问题设计目标和技术方案的各种因素，能够提出仪器仪表、流程工业等相关领域复杂工程问题的解决方案。



<p>复杂工程问题设计解决方案，设计满足特定需求的系统、单元（部件），并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素。</p>	<p>3-2.能够根据用户的特定需求，设计合理的智能测控系统、单元。</p> <p>3-3.能够在设计中综合考虑社会、健康、安全、环境、法律等现实约束条件，并体现创新意识。</p>
<p>毕业要求 4： 能够基于科学原理并采用科学方法对仪器仪表、智能检测与控制的复杂工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。</p>	<p>4-1.能够基于专业理论，根据对象特性，选择研究路线。</p> <p>4-2.能够基于科学原理并采用科学方法对仪器仪表、流程工业等相关领域的复杂工程问题设计实验方案，采用科学的实验方法，合理规范地进行实验并获取数据。</p> <p>4-3.能对实验结果进行分析和解释，并通过信息综合得到合理有效的结论。</p>
<p>毕业要求 5： 能够针对流程工业等相关领域的仪器仪表、智能测控系统的复杂工程问题，开发、选择与使用恰当的技术、资源、现代工程工具和信息技术，对复杂工程问题进行预测与模拟，并能够理解其局限性。</p>	<p>5-1.具备计算机、网络及现代工程工具的知识，掌握现代仪器仪表、建模和软件开发工具、EDA 仿真及设计等软硬件工具的使用原理和方法。</p> <p>5-2.能够选择与使用恰当的仪器设备、信息资源、建模和软件开发工具、EDA 软硬件开发工具，对复杂工程问题分析，进行设计与开发，包括对复杂工程问题的预测与模拟，并能够分析其局限性。</p>
<p>毕业要求 6： 能够基于流程工业等领域相关的背景知识，对智能检测与控制工程实践和复杂工程问题解决方案进行合理分析，评价其对社会、健康、安全、法律以及文化的影响，并理解测控专业工程师应承担的责任。</p>	<p>6-1.能够在实习、专业实践以及社会实践等学习中，理解与使用与仪器仪表及相关行业相关的技术标准、产业规范，尊重相关领域的知识产权和法律法规。</p> <p>6-2.能够评价工程实践和复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响，理解在相关工程实践中应承担的责任。</p>
<p>毕业要求 7： 能够理解和评价针对流程工业等领域的智能测控复杂工程问题的工程实践对环境、社会可持续发展的影响。</p>	<p>7-1.知晓和理解环境保护和可持续发展的理念和内涵。</p> <p>7-2.能够站在环境保护和可持续发展的角度考虑仪器仪表、流程工业等相关领域工程实践的可持续性，评价仪器仪表、流程工业等相关领域工程全周期中可能对人类和环境造成的影响，并减少隐患和影响。</p>
<p>毕业要求 8： 具有人文社会科学素养、社会责任感，能够在流程工业等领域的仪器仪表、智能测控等工程实践中理解并遵守工程职业道德和规范，履行责任。</p>	<p>8-1.具有正确的世界观、价值观、人生观，具有良好的人文社会科学素养、社会责任感，树立和践行社会主义核心价值观，明确个人作为社会主义事业建设者和接班人所肩负的责任和使命，了解中国国情。</p> <p>8-2.理解诚实公正、诚信守则的工程师职业道德和规范，并能在仪器仪表、流程工业等相关工程领域工程实践中遵守并承担责任。</p>
<p>毕业要求 9： 能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。</p>	<p>9-1.在仪器仪表与流程工业领域工程实践团队中，能够和多学科成员沟通共事，能够独立或合作完成相应的任务。</p> <p>9-2.在仪器仪表与流程工业领域工程实践中，理解团队成员与负责人的角色，具备团队领导能力。</p>
<p>毕业要求 10： 能够就仪器仪表、智能测控等复杂工程问题与业界同行及社会公众进行有效沟通和交流，包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令，并具备一定的国际视野，能够在跨文化背景下进行沟通和交流。</p>	<p>10-1.能够就仪器仪表、流程工业等相关工程领域专业问题与业界同行和社会公众进行有效的口头和书面表达、人际交流、电子及多媒体交流。</p> <p>10-2.具备外语交流能力，具有一定的国际化视野，能够在跨文化背景下进行沟通和交流。</p>

毕业要求 11: 理解并掌握智能测控工程等方面的工 程管理原理与经济决策方法,并能在多 学科环境中应用。	11-1.理解并掌握仪器仪表、流程工业等相关工程中涉及的管理与经济决策方法。
	11-2.能够应用工程管理原理与经济决策方法对仪器仪表、流程工业领域的复杂工程问题进行有效分析和综合评价,提出经济、合理的解决方案。
毕业要求 12: 具有自主学习和终身学习的意识,具有 不断学习和适应发展的能力。	12-1.能够对自我探索和终身学习的必要性有正确认识,具有自主学习的意识。
	12-2.充分认识到智能仪器、流程工业等相关工程领域的快速发展以及自主学习、终身学习的重要性,具有健康良好的心理、身体素质,以适应工作中的各种任务。

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。

### 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标			
	培养目标 1	培养目标 2	培养目标 3	培养目标 4
1: 工程知识	√			
2: 问题分析	√			
3: 设计/开发解决方案	√	√		
4: 研究		√		
5: 使用现代工具		√		
6: 工程与社会		√	√	
7: 环境和可持续发展			√	
8: 职业规范			√	
9: 个人和团队			√	
10: 沟通			√	√
11: 项目管理		√		√
12: 终身学习				√

#### 四、主干学科

仪器科学与技术

#### 五、专业核心课程

电路分析基础、模拟电子技术、数字电子技术、计算机控制技术、自动控制原理、误差理论与数据处理、传感器原理及应用、智能仪表原理及设计、化工过程检测技术及仪表、嵌入式系统。

#### 六、修业年限

本科基本学制 4 年,弹性学习年限 3-6 年,按照学分制度管理。

#### 七、授予学位

学生应至少修满 167.5 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者,可授予工学学士学位。

## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例 (%)
通识教育课	通识教育必修课	思政类	必修	17	43.5	26
		外语类		12		
		计算机类		4.5		
		军事安全类		2		
		劳动体育类		5		
		创新创业类		2		
		心理健康类		1		
	通识教育选修课	美育类 (400)	选修	2	8	4.8
		中国与世界(500)		2		
		四史(600)		1		
		经济管理类(700) 技术经济与工程项目管理		1		
		传统文化(900)		2		
	通识教育实践课	军训	实践	2	2	1.2
学科平台课	学科基础课程	公共基础类	必修	63.5	63.5	68
		专业基础类				
	学科实践课程	-	实践			
专业教育课	专业核心课程	-	必修	16.5	42.5	
	专业选修课程	-	选修	4		
	专业实践课程	-	实践	22		
能力拓展课	专业特色课程	-	必修 (或实践)	8	8	
课外环节	课外通识实践	人文社会实践	课外实践	4		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
	生涯教育	成长规划类		1		
总学分/比例					167.5	100

# Measurement and control technology and instrument 2021

## Undergraduate Education Program

### I. Educational Objectives

#### Educational Objectives

This major aim to cultivate the application-oriented engineering and technical talents and socialist successors with good comprehensive quality, all-round development of morality, intelligence, sports, beauty and labor who can be engaged in the analysis, design, development, operation and management of instruments and intelligent measurement and control systems in the field of process industry.

About 5 years after graduation from this major:

(1) Have the ability to skillfully use engineering mathematical knowledge and measurement and control professional knowledge to solve engineering problems such as instrumentation, intelligent measurement and control in process industry and other fields.

(2) It has the ability to use modern tools and advanced technology for innovative analysis, design, integration and service of instruments and intelligent measurement and control systems in process industry and other fields.

(3) Have a correct world outlook and outlook on life, have the ability of effective communication, expression and project management, have a good team spirit, and be able to comprehensively consider legal, environmental, social, economic and other factors in engineering practice.

(4) With broad international vision, actively adapt to the changing situation and environment at home and abroad, have the ability of lifelong learning, and be competent for the continuous development of measurement and control technology.

### II. Major direction

Intelligent measurement and control direction

### III. Graduation Requirements

According to the talent training objectives of this major and the many years of talent training experience of Measurement and control technology and instrument in our university, starting from the needs of social development, it is clear that the graduation requirements of this major at this stage are as follows:

Graduation Requirements	Indices
Requirement 1: Be able to apply the theories and methods of mathematics, natural science, and other fields, as well as the engineering foundation and professional knowledge, skills and	1-1. Using mathematics, natural science, engineering foundation and professional knowledge to discover and express general engineering problems.
	1-2. After reasonable simplification, reasoning and analysis, the mathematical model of instrumentation in the whole life cycle is established and solved by comprehensive application of the professional knowledge of measurement and control.

tools of measurement and control, and take the design project as the carrier to solve the complex engineering problems related to instrumentation, measurement and control in process industry and other fields.	1-3. Master the professional knowledge in instrumentation, process industry and other fields, and be able to deduce and analyze the complex engineering problems in instrumentation, process industry and other fields.
	1-4. Be able to use mathematics, natural science, engineering foundation and professional knowledge to solve complex engineering problems in instrumentation, process industry and other fields.
Requirement 2: It can apply the basic principles of mathematics, natural science, and engineering science to identify, express and analyze complex measurement and control engineering problems in process industry and other fields through literature research, to obtain effective conclusions.	2-1. Be able to use the basic principles of mathematics, natural science, and engineering science to identify the key links of complex engineering problems in instrumentation, process industry and other related fields.
	2-2. It can correctly express complex engineering problems in instrumentation, process industry and other related fields through the basic principles and mathematical models of measurement and control technology.
	2-3. Be able to use engineering foundation and professional knowledge to analyze complex engineering problems in instrumentation, process industry and other related fields through literature research, and obtain effective conclusions.
Requirement 3: Be able to design solutions for complex engineering problems such as instrumentation, intelligent detection and control, design systems, units (components) to meet specific needs, and reflect the sense of innovation in the design process, considering social, health, safety, legal, cultural, and environmental factors.	3-1. Understand the various factors that affect the design objectives and technical solutions of engineering problems in instrumentation, process industry and other fields, and be able to propose solutions to complex engineering problems in instrumentation, process industry and other related fields.
	3-2. According to the specific needs of users, we can design reasonable intelligent measurement and control system and unit.
	3-3. The design can comprehensively consider social, health, safety, environment, legal and other practical constraints, and reflect the sense of innovation.
Requirement 4: Based on scientific principles and scientific methods, we can study the complex engineering problems of instrumentation, intelligent detection, and control, including designing experiments, analyzing, and interpreting data, and getting reasonable and effective conclusions through information synthesis.	4-1. Be able to choose research route based on professional theory and object characteristics.
	4-2. Based on scientific principles and scientific methods, we can design experimental schemes for complex engineering problems in instrumentation, process industry and other related fields, and use scientific experimental methods to conduct experiments and obtain data in a reasonable and standardized way.
	4-3. It can analyze and explain the experimental results, and get reasonable and effective conclusions through information synthesis.
Requirement 5: Be able to develop, select and use appropriate technology, resources, modern engineering tools and information technology to predict and simulate complex engineering problems, and understand their limitations.	5-1. Have the knowledge of computer, network, and modern engineering tools, master the use principle and method of modern instruments, modeling and software development tools, EDA Simulation and design and other software and hardware tools.
	5-2. Be able to select and use appropriate instruments and equipment, information resources, modeling and software development tools, EDA software and hardware development tools to analyze, design and develop complex engineering problems, including prediction and Simulation of complex engineering problems, and be able to analyze their limitations.

<p><b>Requirement 6:</b> Based on the relevant background knowledge of process industry and other fields, reasonably analyze the intelligent detection and control engineering practice and complex engineering problem solutions, evaluate their impact on society, health, safety, law, and culture, and understand the responsibilities of measurement and control professional engineers.</p>	<p>6-1. Be able to understand and use the technical standards and industrial norms related to instruments and related industries in internship, professional practice, and social practice, and respect the intellectual property rights and laws and regulations in related fields.</p>
	<p>6-2. Be able to evaluate the impact of engineering practice and complex engineering problem solutions on society, health, safety, law, and culture, and understand the responsibilities in relevant engineering practice.</p>
<p><b>Requirement 7:</b> Be able to understand and evaluate the impact of the engineering practice of intelligent measurement and control complex engineering problems in the field of process industry on the sustainable development of environment and society.</p>	<p>7-1. Know and understand the concept and connotation of environmental protection and sustainable development.</p>
	<p>7-2. Be able to consider the sustainability of engineering practice in instrumentation, process industry and other related fields from the perspective of environmental protection and sustainable development, evaluate the possible impact on human and environment in the whole cycle of Engineering in instrumentation, process industry and other related fields, and reduce hidden dangers and impacts.</p>
<p><b>Requirement 8:</b> Have humanities and social science literacy, sense of social responsibility, be able to understand and abide by the engineering professional ethics and norms in the process industry and other fields of instrumentation, intelligent measurement, and control engineering practice, and fulfill the responsibility.</p>	<p>8-1. We should have a correct world outlook, values, and outlook on life, have a good quality of Humanities and Social Sciences and a sense of social responsibility, establish, and practice the socialist core values, clarify the responsibilities and missions of individuals as builders and successors of the socialist cause, and understand China's national conditions.</p>
	<p>8-2. Understand the engineer's professional ethics and norms of honesty, justice, and integrity, and be able to abide by and take responsibility in the engineering practice of instrumentation, process industry and other related engineering fields.</p>
<p><b>Requirement 9:</b> Be able to play the role of individual, team member and leader in a multidisciplinary team.</p>	<p>9-1. In the field of instrumentation and process industry engineering practice team, be able to communicate and work with multidisciplinary members, and be able to complete corresponding tasks independently or cooperatively.</p>
	<p>9-2. Understand the roles of team members and leaders in the field of instrumentation and process industry, and have the ability of team leadership.</p>
<p><b>Requirement 10:</b> Be able to effectively communicate with peers in the industry and the public on complex engineering issues such as instrumentation and intelligent measurement and control, including writing reports and design manuscripts, making statements, clearly expressing, or responding to instructions, and have a certain international vision, and be able to</p>	<p>10-1. Be able to effectively communicate with peers in the industry and the public in terms of oral and written expression, interpersonal communication, electronic and multimedia communication on professional issues in instrumentation, process industry and other related engineering fields.</p>
	<p>10-2. Have the ability of foreign language communication, have a certain international vision, be able to communicate and exchange in the cross-cultural background.</p>

communicate and exchange in a cross-cultural context.	
Requirement 11: Understand and master the engineering management principles and economic decision-making methods of intelligent measurement and control engineering, and be able to apply them in multidisciplinary environment.	11-1. Understand and master the management and economic decision-making methods involved in instrumentation, process industry and other related projects.
	11-2. Able to apply engineering management principles and economic decision-making methods to effectively analyze and comprehensively evaluate complex engineering problems in instrumentation and process industry, and put forward economic and reasonable solutions.
Requirement 12: Have the consciousness of self-learning and lifelong learning, have the ability of continuous learning and adapting to development.	12-1. Be able to have a correct understanding of the necessity of self-exploration and lifelong learning, and have the consciousness of autonomous learning.
	12-2. Fully aware of the rapid development of intelligent instruments, process industry and other related engineering fields, as well as the importance of self-learning and lifelong learning, with good psychological and physical quality to adapt to various tasks in the work.

Professional graduation requirements should be able to support the achievement of training objectives.

Establish the relationship matrix of graduation requirements to support the realization of training objectives.

### The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives			
	Educational Objectives 1	Educational Objectives 2	Educational Objectives 3	Educational Objectives 4
1: Engineering Knowledge	√			
2: Problem Analysis	√			
3: Design/Development Solutions	√	√		
4: Research		√		
5: Use Modern Tools		√		
6: Engineering and Society		√	√	
7: Environment and Sustainable Development			√	
8: Career Planning			√	
9: Individuals and Teams			√	
10: Communicate			√	√
11: Project Management		√		√
12: Lifelong Learning				√

## IV. Major Subject

Instruments Science and Technology.

## **V. Core Courses**

Fundamentals of circuit analysis, Analog electronic technology, Digital electronic technology, Computer Control Technology, The Principle of Automatic Control, Error Theory and Data Processing, Sensor Principle and Application, The Design and Principal of Intelligent Instrument, Chemical Process Detection Techniques and Sensors, The Embedded System.

## **VI. Educational System**

The basic length of undergraduate education is 4 years, and the flexible study period is 3-6 years. It is managed according to the credit system.

## **VII. Confer Degrees**

Students should complete at least 167.5 credits before graduation. The Bachelor of engineering degree can be granted to those who meet the degree awarding requirements of the relevant regulations on the awarding of bachelor's degree for graduates of Shenyang University of Chemical Technology (revised in March 2017).



## VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit Requirement	Subtotal	Proportion (%)
General Education	Subject Platform Course General Education Compulsory Course	Ideological and Political Education	Compulsory	17	43.5	26
		Foreign Languages		12		
		Computer		4.5		
		Military Security		2		
		Labor Sports		5		
		Innovation and Entrepreneurship		2		
		Mental Health		1		
	General Education Elective Subjects	Aesthetic Education (400)	Elective	2	8	4.8
		China and the World (500)		2		
		Four Histories (600)		1		
		Economic Management (700)		1		
Traditional Culture (900)		2				
General Education Practice Course	Military Training	Practice	2	2	1.2	
Discipline Education	Basic Subject Courses	Public Basic Class	Compulsory	63.5	63.5	
		Professional Foundation				
	Subject Practice course	-	Practice			
Specialized Education	Professional Core Courses	-	Compulsory	16.5	42.5	68
	Professional Elective Courses	-	Elective	4		
	Professional Practice Courses	-	Practice	22		
Competency Development	Professional Characteristic Courses	-	Compulsory (or Practice)	8	8	
Extracurricular Links	Extracurricular General Knowledge Practice	Humanistic Social Practice	Extracurricular Practice	4		
		Physical and Mental Health Practice				
		Foreign Language Skills Practice				
	Innovation and Entrepreneurship Practice	Innovation Training		4		
		Innovation Competition				
		Maker Activities				
Career Education	Growth Planning	1				
Total Credits / Proportion					167.5	100

## 九、测控技术与仪器专业教学进程表

### Table of Teaching Schedule for Measurement and control technology and instrument Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th		
通识教育课 General Education	必修 Compulsory	思政类 Ideological and Political Courses	0710093001	思想道德与法治    Ideological Morality and the Rule of Law	3.0	48	32			16		2								
			0710053001	中国近现代史纲要   Outline of Chinese Contemporary and Modern History	3.0	48	32			16	2									
			0710103001	马克思主义基本原理*   Basic Principles of Marxism*	3.0	48	32			16				2						
			0710133001	毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3.0	48	32			16				2						
			0710123001	习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8					3					
			0710012301	形势与政策   Current Situation and Policies	2.0	64	64				2	2	2	2	2	2	2	2	2	
		外语类 Foreign Language Courses	0211003101	大学外语I   College English I	3.0	48	48				3									
	0211003201		大学外语II*   College English II*	3.0	48	48					3									
	0241003301		大学外语III   College English III	3.0	48	48						3								
			大学外语III（进阶英语）    College English III（Advanced English CET 6-Orientated）	3.0	48	48						3								五选一





课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
						讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th		
合计 Total				52.5															
学科平台课 Discipline Education	必修 Compulsory	数学与自然科学类 Natural Science & Mathematics	0310004101	高等数学 I*   Advanced Mathematics I*	4.5	80	72		8	6									
			0310005201	高等数学 II*   Advanced Mathematics II*	5.5	96	88		8	6									
			0310032001	线性代数    Linear Algebra	2.0	32	32			3									
			0310042001	概率论与数理统计   Probability and Statistics	2.0	32	32						2						
			1510251002	复变函数   Function of Complex Variable	1.5	24	24					2							
			1511331002	近代物理学   Modern Physics	1.0	16	16						2						
			0310063101	大学物理 I*   University Physics I*	3.0	48	46	2				3							
			0310063201	大学物理 II*   University Physics II*	3.0	48	46	2					3						
		工程基础类 Foundation Engineering	1510163002	电路分析基础*    Fundamentals of circuit analysis *	3.5	56	56					4							
			1510913002	模拟电子技术*   Analog electronic* technology	3.5	60	48	12					3						
			1510923002	数字电子技术*   Digital Electronic Technology*	3.5	60	48	12						3					
			1514992002	微机原理及应用   Microcomputer Principle and Application	2.5	42	36	6							3				
			1510141002	电气工程制图及 CAD   Electrical Engineering Drawing and CAD	1.5	26	20		6			2							

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th			
学科平台课 Discipline Education	必修 Compulsory	专业基础类 Subject Foundation Requisite	1111042002	化学工艺学    Chemical Process Technology	2.0	32	32						3								
			1511364002	自动控制原理*   The Principle of Automatic Control*	4.0	68	56	8	4				4								
			1513231002	测控技术与仪器专业概论    Introduction to the Specialty of Measurement and Control Technology and Instrument	1.0	18	12	6			2										
			1514882002	信号与系统I*   Signals and Systems I*	2.5	42	36	6					3								
			1513272002	算法与数据结构   Algorithm and Data Structure	2.5	44	32		12					3							
			1513881102	测控专业外语   Specialty English for Measurement & Control Technology and Instrument	1.0	16	16								2						
			1513841302	测控专业科技论文写作与文献检索   Scientific Paper Writing and Literature Searching for Measurement /Control Technology and Instrument	1.0	16	16										2				
			小计 Subtotal				51	856	764	54	22	16	11	17	14	12	5	2			
	实践 Practice			0310081011	大学物理实验   Physical experiment of college	1	24	6	18				3							分散	
				1410071031	金工实习   Metalworking Practice	1	24		24				+1								集中
				1513162032	生产实习   Production Practice	2	48		48										+2		集中

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
						讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八		
										1st	2nd	3rd	4th	5th	6th	7th	8th		
学科平台课 Discipline Education	实践 Practice	1512212032	电子工艺实习   Electronic Process Practice	2	48		48					+2						集中	
		1510141024	电子技术课程设计   Course Design with Electronic Technique	1	24		24					+1							集中
		1514242022	工程数学实践   Engineering Mathematics Practice	2	48		48					+2							集中
		1510150012	电路分析基础实验   Circuit Analysis Experiment	0.5	12		12			√									分散
		1513261022	虚拟仪器课程设计   Design of Virtual instrument	1.5	36		36								+1.5				集中
		1513181022	电子线路辅助设计课程设计   Assistant Design of Electronic Circuit	1.5	36		36						√						分散
		小计 Subtotal				12.5	300	6	294										
合计 Total				63.5	1156	770	348	22	16										
专业教育课 Specialized Education	必修 Compulsory	1513032002	传感器原理及应用*   Sensor Principle and Application*	2.5	42	36	6							3					
		1513022002	误差理论与数据处理   Error Theory and Data Processing	2.0	32	32								3					
		1523733002	化工过程检测技术及仪表*   Chemical Process Detection Techniques and Sensors*	3.0	50	44	6									3			
		1523963002	智能仪表原理及设计*   The Design and Principal of Intelligent Instrument*	3.5	60	48	12								3				
		1526092002	嵌入式系统   The Embedded System	2.5	46	28	18										2		
		1511413002	计算机控制技术*   Computer Control Technology*	3.0	52	40	12										3		

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
										1st	2nd	3rd	4th	5th	6th	7th	8th		
		小计 Subtotal		16.5	282	228	54							9	8				
专业教育课 Specialized Education	选修 Optional	1531033002	现代控制理论   Modern Control Theory	3.0	52	40	8	4							3				
		1534863002	大数据原理与技术   Principle and Technology of Big Data	3.0	56	32		24								4			
		1531992002	仿真技术    Simulation Technology	2.0	36	24		12					2						
		1533912002	FPGA 原理及设计   Principle and Design of FPGA	2.0	36	24	12							2					
		1537042002	计算机网络与通信技术   Computer Network and Communication Technology	2.0	32	32							2		2				
		1538563002	ZigBee 技术应用及无线传感器网络   ZigBee Technology and Wireless Sensor Networks	3.0	52	40	12							3					
		1534962002	C#程序设计   C# Program Design	2.0	36	24		12					2						
		1534862002	数字信号处理器原理及应用   Principle and Application of Digital Signal Processors	2.0	36	24		12								2			
		1534872002	语音信号处理   Speech Signal Processing	2.0	36	24		12							2				
		1534932002	面向对象程序设计   Object-oriented Programming	2.0	36	24		12					2						
				小计 Subtotal		23	408	288	32	88			2	2	5	2	6		
			修读要求 Fill in the Study Requirements			4.0													
	实践 Practice	1513292022	智能仪表课程设计    The Course Design of Intelligent Instrument	2	48		48									√		分散	



课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes			
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八				
											1st	2nd	3rd	4th	5th	6th	7th	8th				
专业教育课 Specialized Education	实践 Practice		1513912022	化工过程检测技术及仪表综合实训   Comprehensive Training of Chemical Process Detection Technology and Instrumentation	2	48		48									+2		集中			
			1513102022	机器人课程设计   The Course Design of robot	2	48		48											√		分散	
			1513062022	智能测控综合实训 Comprehensive Training of Intelligent Measurement and Control	2	48		48												√		分散 CDIO课程
			1513174042	毕业设计（论文）   Graduation Design (Thesis)	14																+17	集中
			小计 Subtotal				22	192		192												
合计 Total					42.5																	
能力拓展课 Competency Development	必修或实践 Compulsory or Practice		1512061002	可编程控制器原理与应用   The Principle and Application of Programmable Controller	1.5	26	20	6										2				
			1524482002	Python 机器学习   Python Machine Learning	2.5	48	24		24										2			
			1523992002	机器人控制    Robot control	2.0	36	24	12												2		
			1513012002	虚拟仪器基础    Fundamentals of virtual instrument	2.0	36	24	12												2		
			小计 Subtotal				8.0	146	92	30	24									4	4	
修读要求 Fill in the Study Requirements 8.0																						
总计 Sum					167.5						17.5	30	22	25	21.5	22.5	15	16				
课外环节 Extracurricular	课外实践 Extracurricular practice	人文社会实践 Culture and Society Practice	1513401032	社会调查   Social Survey	0.5	12													0.5	分散		

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八	
											1st	2nd	3rd	4th	5th	6th	7th	8th	
课外环节 Extracurricular	身心健康社会实践 Mentally and Physically Practice	0410050751	课外体育锻炼   Extracurricular Physical Exercise	0.5	12				12							0.5		分散	
		2640030011	劳动教育实践   Labour Education Practice	0.5	12				12		0.5							分散	
		0510070311	心理健康辅导   Mental Health Counseling	0.5	12				12							0.5		分散	
	外语技能实践类 Foreign Language Proficiency Training Practice	0210010011	外语技能实践（初级）   Foreign Language Proficiency Training Practice (elementary)	2.0	48				48				2					二选一	
		0210020011	外语技能实践（高级）   Foreign Language Proficiency Training Practice (advanced)	2.0	48				48				2						
	成长规划类 Growth Planning Courses	1510271312	职业规划与就业指导   Career Planning and Employment Guidance	1.0	40	40				1						1			
	能力与创新实践 Capability and Innovation Practice	1513414022	大学生素质拓展与创新实践   Quality Development and Innovation Practice	4.0	96				96	1~8 学期依据《沈阳化工大学创新创业实践学分认定办法》由创新创业学院认定								分散	
小计 Subtotal																			

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5,课程名称中画\*为考试课。

## 十、测控技术与仪器专业学士学位课程一览表

### A list of bachelor's degree programs in Measurement and control technology and instrument Major

课程类别 Course Type	模块名称 Modules	序号 No.	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester	
通识教育课 General Education	政治理论 Political Theory	1	0710103001	马克思主义基本原理* Elementary Theory of Marxism	3	3	
		2	0710133001	毛泽东思想和中国特色社会主义理论体系概论* Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3	4	
学科平台课 Discipline Education	数学 Mathematics	3	0310004101	高等数学I* Advanced Mathematics I*	4.5	1	
	物理 Physics	4	0310063101	大学物理I* University Physics I*	3	2	
	工程基础类 Foundation Engineering	5	1510923002	数字电子技术* Digital electronic technology	3.5	4	
		6	1514992002	微机原理及应用* Microcomputer Principle and Application	2.5	5	
		7	1510163002	电路分析基础* Circuit Analysis	3.5	2	
	专业基础 Subject Foundation Requisite	8	1511364002	自动控制原理* The Principle of Automatic Control	4	4	
		9	1513032002	传感器原理及应用* Sensor Principle and Application	2.5	5	
		10	1513022002	误差理论与数据处理 Error Theory and Data Processing	2	5	
		11	1514882002	信号与系统I* Signals and Systems I	2.5	3	
	专业教育课 Specialized Education	智能测控类	12	1523063002	智能仪表原理及设计* The Design and Principal of Intelligent Instrument	3.5	5
			13	1526092002	嵌入式系统 The Embedded System	2.5	6
14			1511413002	计算机控制技术* Computer Control Technology	3	6	
15			1523733002	化工过程检测技术及仪表* Chemical Process Detection Techniques and Sensors	3	6	

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》

### 十一、全学程实践环节周历安排 Weekly Calendar of all Practice Sessions

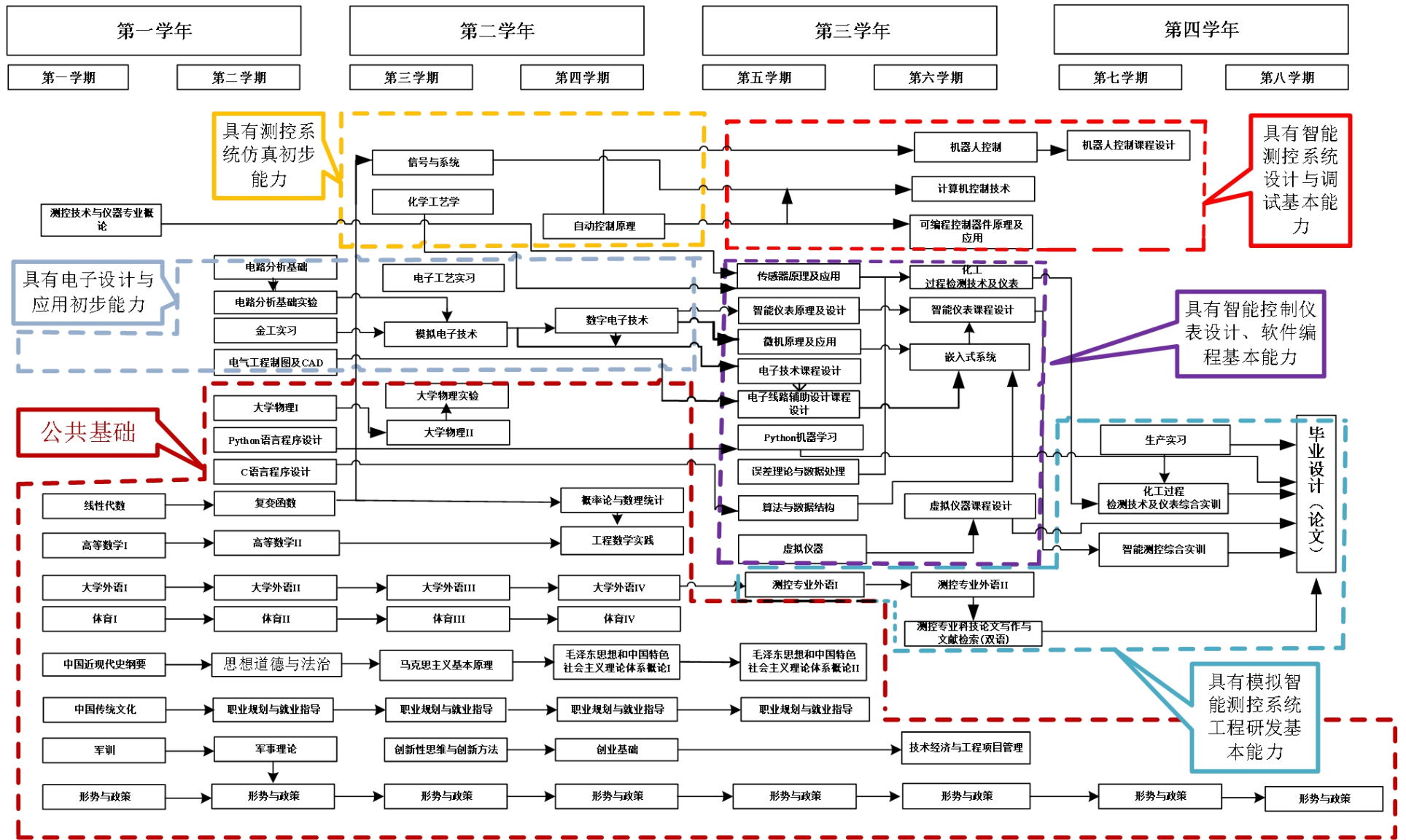
学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注
一		☆	☆															::	::	•		
二													※					::	::	•		
三													P	P				::	::	•		
四														P	P			::	::	•		
五																		::	::	•		
六																		::	::	•		
七	△	△	△	△	/	/	△	△										::	::	•		
八	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=					

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符号说明(Symbol Description):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P 各类实训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼ 认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计(论文)||Graduation Project(Thesis)    ·小学期||Primary Term

### 十二、课程体系配置图 Curriculum System Configuration Diagram



十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements ( High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																												
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	6.1	6.2	7.1	7.2	8.1	8.2	9.1	9.2	10.1	10.2	11.1	11.2	12.1	12.2
马克思主义基本原理*    Basic Principal of Marxism*																					M								
中国近现代史纲要   Outline of Chinese Contemporary and Modern History																					M								
思想道德修养与法律基础    Cultivation of Ideological Morality and Basis of Law																					M								
毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics *																					M								
习近平新时代中国特色社会主义思想概论     Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																					M								
大学外语I-IV   College English I-IV																									M				M
劳动教育    Labour Education																					L		M						
C 语言程序设计   C Programming Language																													
大学体育I-IV   College Physical Education I-IV																							M						M











# 沈阳化工大学本科培养方案

## 信息工程学院

专业名称：电气工程及其自动化

专业代码：080601

制 定：蔡庆春

审 核：孔晓光

审 定：于三三

批 准：金志浩

2021年8月

# 电气工程及其自动化专业培养方案

## 一、培养目标

本专业培养具有社会责任感，能够在电气控制、智能电网等领域从事相关的科学研究、工程设计、技术开发和项目管理等工作的高素质应用型工程技术人才，能够适应国家和区域经济发展要求，德智体美劳全面发展的社会主义接班人。

毕业 5 年后：

(1) 具有扎实的理论基础，具备适应装备制造等领域发展的专业能力和专业视野，能够综合运用数学、自然科学、专业知识以及交叉学科知识，对电气工程及相关领域复杂工程问题的解决方案进行分析和设计。

(2) 具有在企业与社会环境下，运用现代工具对装备制造业及相关领域的电气控制系统进行分析、设计、集成和服务的能力。

(3) 具有高度的社会责任感和道德修养、健全的人格、良好的心理素质和人文科学素养、和谐包容的团队精神、有效的沟通与表达能力和工程项目管理能力，在工程实践中能综合考虑法律、环境与可持续性发展等因素，具有坚持公众利益优先的素质。

(4) 具有广阔的国际视野，主动适应不断变化的国内外形势和环境，能够通过多种学习渠道更新知识，形成终生学习的习惯，实现能力和技术水平的提升。

## 二、专业方向

电气控制、智能电网

## 三、毕业要求

本方案根据本科专业类教学质量国家标准、专业认证标准中的要求，基于成果导向教育理念，依据人才培养目标和专业多年形成的人才培养特色，针对电气工程领域及电气工程及其自动化专业的特点，制定本专业毕业能力要求和指标点分解。

毕业能力要求及其指标点分解：

毕业能力要求	指标点
毕业要求 1： 工程知识：掌握数学、自然科学、工程基础和电气专业知识，能够运用其理论和方法解决装备制造业及相关工程领域电气控制系统和智能电网的复杂工程问题。	1-1. 能够将数学、自然科学、工程基础和专业知识运用到复杂工程问题的恰当表述中。
	1-2. 能够将工程基础知识应用于电气控制单元及电力生产过程的设计和分析。
	1-3. 能够将工程基础和专业知识用于装备制造业及相关工程领域电气控制系统和智能电网工程问题的分析和优化。
	1-4. 能够将工程基础和专业知识用于装备制造业及相关工程领域电气控制系统和智能电网的设计和改进行。
毕业要求 2： 问题分析：能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究来分析装备制造业及相	2-1. 能够运用数学、自然科学和工程科学的基本原理，识别装备制造业及相关工程领域电气控制系统、智能电网复杂工程问题中的关键环节和参数。
	2-2. 能够通过系统集成分析、基于设备运行操作指标分析等方法正确表达装备制造业及相关工程领域电气控制系统和智能电网的复杂工程问题。

关工程领域电气控制系统和智能电网的复杂工程问题，以获得有效结论。	2-3. 能够通过文献研究来分析装备制造业及相关工程领域电气控制系统和智能电网的复杂工程问题，以获得有效结论。
	2-4 能够运用智能电网专业知识分析电力生产过程的影响因素、证实解决方案的合理性。
毕业要求 3： 设计/开发解决方案：在综合考虑社会、健康、安全、法律、文化以及环境等因素的前提下，能够针对装备制造业及相关工程领域电气控制系统和智能电网的复杂工程问题设计解决方案，设计满足特定需求的系统、单元（部件），并能够在设计环节中体现创新意识。	3-1. 能够在综合考虑社会、健康、安全、法律、文化以及环境等现实约束条件下，对装备制造业及相关工程领域电气控制系统的复杂工程问题设计解决方案。
	3-2. 能够根据用户的特定需求，设计合理的电气控制系统和智能电网系统。
	3-3. 能够通过集成单元过程完成电气控制系统和电力生产的流程设计，并对电气控制和智能电网设计方案进行优化，体现创新意识。
毕业要求 4： 研究：能够基于科学原理并采用科学方法对装备制造业及相关工程领域电气控制系统和智能电网的复杂工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。	4-1. 能够基于专业理论，根据对象特性，选择研究路线，设计可行的实验方案。
	4-2. 能够基于科学原理并采用科学方法对电气控制相关的复杂工程问题设计实验方案，开展实验，分析与解释数据。
	4-3. 能够针对电气控制和智能电网相关的复杂工程问题进行应用研究，并通过信息综合得到合理有效的结论。
毕业要求 5： 使用现代工具：掌握文献检索、资料查询以及运用现代信息技术获取相关信息的基本方法，能够针对装备制造业及相关工程领域电气控制系统和智能电网的复杂工程问题，开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具，包括对复杂工程问题的预测与模拟，并能够理解其局限性。	5-1. 掌握文献检索、资料查询以及运用现代信息技术获取相关信息的基本方法。
	5-2. 能够正确选择与使用仿真工具、人机界面集成工具等技术、资源，对装备制造业及其相关的复杂工程问题进行预测与模拟。
	5-3. 在解决电气控制和智能电网相关的复杂工程问题实践中提高现代工具的应用能力，并能够理解其局限性。
毕业要求 6： 工程与社会：能够基于电气工程相关背景知识进行合理分析，评价电气专业工程实践和复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。	6-1. 了解与电气工程背景相关的社会、健康、安全、法律及文化方面的知识。
	6-2. 掌握社会主义核心价值观的内涵和意义，在正确价值观的指导下，合理分析和评价电气专业工程实践和复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响，理解电气工程师所应承担的社会责任。
毕业要求 7： 环境和可持续发展：能够理解和评价针对装备制造业及相关工程领域电气控制系统及智能电网的复杂工程问题的工程实践对环境、社会可持续发展的影响。	7-1. 能够理解和体验针对电气控制和智能电网相关的复杂工程问题的工程实践对环境、社会可持续发展的影响。
	7-2. 能够运用环境与可持续发展等相关法律法规分析、评价针对电气控制和智能电网相关的复杂工程问题的工程实践对环境、社会可持续发展的影响。
毕业要求 8： 职业规范：具有人文社会科学素养、社会责任感，能够在装备制造业及相关工程领域电气控制系统的工程实践中理解并遵守工程职业道德和规范，履行责任。	8-1. 具备科学的世界观、人生观和价值观,理解个人与社会的关系，了解中国国情。
	8-2. 能在工程实践中自觉遵守工程职业道德和规范，诚实公正、诚信守则、爱岗敬业、敬爱生命。
	8-3. 能够在工程实践中自觉履行对公众安全、健康、福祉和环境保护的社会责任。

<p>毕业要求 9:</p> <p>个人和团队:能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。</p>	9-1. 理解团队合作的意义,能够在工程项目的研发和实施过程中,与不同学科领域人员进行有效沟通,合作共事。
	9-2. 具有良好大局观念,能够在团队中根据需要独立或合作开展工作。
	9-3. 能够在多学科交叉背景下,组织、协调和带领团队开展工作。
<p>毕业要求 10:</p> <p>沟通:能够就装备制造业及相关工程领域电气控制系统的复杂工程问题与业界同行及社会公众进行有效沟通和交流,包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令,并具备一定的国际视野,能够在跨文化背景下进行沟通和交流。</p>	10-1. 能够运用语言工具准确表达自己的观点,能与业界同行和公众进行有效沟通和交流。
	10-2. 了解装备制造业及相关工程专业领域国际发展趋势和热点问题。
	10-3. 理解并尊重文化差异,能够就电气控制和智能电网相关的复杂工程问题,在跨文化背景下进行基本的沟通和交流。
<p>毕业要求 11:</p> <p>项目管理:理解并掌握工程管理原理与经济决策方法,并能在多学科环境中应用。</p>	11-1. 理解并掌握一定的工程管理原理与经济决策方法。
	11-2. 能够应用工程管理原理与经济决策方法对电气控制和智能电网相关的复杂工程问题进行有效分析和综合评价
<p>毕业要求 12:</p> <p>终身学习:具有自主学习和终身学习的意识,有不断学习和适应发展的能力。</p>	12-1. 充分认识到装备制造业及相关工程领域电气控制、智能电网系统的快速发展,能在社会发展的大背景下,认识到不断探索和学习的必要性,具有自主学习和终身学习的意识。
	12-2. 具有自主学习能力,包括对问题的理解能力,归纳能力和提出问题能力等;能够通过自主查阅资料,获取解决问题的知识和方法;掌握终身学习的语言工具和计算机工具,具有健康良好的体魄和心理,以适应工作中的各种任务。

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。

### 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标			
	培养目标 1	培养目标 2	培养目标 3	培养目标 4
1: 工程知识	√			
2: 问题分析	√			
3: 设计/开发解决方案	√			
4: 研究		√		
5: 使用现代工具		√		
6: 工程与社会		√		
7: 环境和可持续发展			√	√
8: 职业规范			√	
9: 个人和团队			√	
10: 沟通			√	√
11: 项目管理			√	
12: 终身学习				√

#### 四、主干学科

电气工程，控制工程。

#### 五、专业核心课程

电路分析基础、模拟电子技术、数字电子技术、电机学、自动控制原理、电力系统分析基础、电力电子技术、电气控制技术、工厂供电、运动控制系统、智能电网技术、电力系统继电保护。

#### 六、修业年限

本科基本学制 4 年，弹性学习年限 3-6 年，按照学分管理制度管理。

#### 七、授予学位

学生应至少修满 164.0 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者，可授予工学学士学位。

## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例(%)
通识教育课	通识教育必修课	思政类	必修	17	41.5	25.30
		外语类		12		
		计算机类		2.5		
		军事安全类		2		
		劳动体育类		5		
		创新创业类		2		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	2	8	4.88
		中国与世界(500)		2		
		四史(600)		1		
		经济管理类(700)		1		
传统文化(900)		2				
通识教育实践课	军训	实践	2	2	1.22	
学科平台课	学科基础课程	公共基础类	必修		69.0	
		专业基础类		59.5		
	学科实践课程	-	实践	9.5		
专业教育课	专业核心课程	-	必修	10.5	38.5	68.60
	专业 选修课程	-	选修	5		
	专业实践课程	-	实践	23		
能力拓展课	专业特色课程	-	必修(或实践)	5	5	
课外实践环节	课外通识实践	人文社会实践	课外实践	4		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
	生涯教育	成长规划类				
总学分/比例					164.0	100



# Electrical Engineering and Automation Major 2021 Undergraduate Education Program

## I. Educational Objectives

### 1. Educational Objectives

This major cultivates high-quality applied engineering and technical talents who have a sense of social responsibility, adapt to the requirements of national and regional economic development, develop morally, intellectually, physically, aesthetically and laboriously, and can engage in scientific research, engineering design, technology development and project management related to electrical control and smart grid in the field of equipment manufacturing.

In 5 years after graduation, graduates will be able to:

(1) Have a solid theoretical foundation, professional ability and professional vision to adapt to the development of equipment manufacturing and other fields, and use mathematics, natural science, professional knowledge and interdisciplinary knowledge to analyze and design solutions to complex engineering problems in electrical engineering and related fields;

(2) Have the ability to analyze, design, integrate and serve the electrical control system in equipment manufacturing industry and related fields with modern tools in the enterprise and social environment;

(3) Have a high sense of social responsibility and moral cultivation, sound personality, good psychological quality and humanities literacy, harmonious and inclusive team spirit, effective communication and expression ability and project management ability, and comprehensively consider factors such as law, environment and sustainable development in engineering practice, and have the quality of giving priority to public interests;

Have a broad international perspective, actively adapt to the changing domestic and international situations and environment, can update knowledge through a variety of learning channels, form lifelong learning habits, and improve their capacity and technical level.

## II. Major direction

Electrical control, smart grid

## III. Graduation Requirements

According to the requirements of the national standards of undergraduate professional teaching quality and professional certification standards, based on the concept of achievement oriented education, according to the talent training objectives and professional training characteristics formed over the years, and in view of the characteristics of the field of electrical engineering and electrical engineering and automation specialty, the graduation ability requirements and index points of this specialty are formulated.

Graduates should obtain knowledge and competences as follows:

Graduation Requirements	Indices
<p>Requirement 1: Engineering knowledge: Master mathematics, natural science, basic engineering foundation and professional electrical knowledge, and be able to use their theories and methods to solve complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields.</p>	1-1. Be able to apply mathematics, natural science, basic and professional engineering knowledge to the proper expression of complex engineering problems.
	1-2. Be able to apply basic engineering knowledge to the design and analysis of electrical control unit and power production process.
	1-3. Be able to apply basic and professional engineering knowledge to analyze and optimize electrical control system and smart grid in equipment manufacturing industry and related engineering fields.
	1-4. Be able to apply basic and professional engineering professional knowledge to designing and improving electrical control system and smart grid in equipment manufacturing industry and related engineering fields.
<p>Requirement 2: Problem analysis: Be able to apply the basic principles of mathematics, natural science and engineering science to identify, express and analyze the complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields through literature research, so as to obtain effective conclusions.</p>	2-1. Be able to use the basic principles of mathematics, natural science and engineering science to identify the key links and parameters in complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields.
	2-2. Be able to express the complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields through system integration analysis and equipment operation index analysis.
	2-3. Through literature research, can analyze the complex engineering problems of electrical control system in equipment manufacturing industry and related engineering through literature research so as to obtain effective conclusions.
	2-4. Be able to use the intelligent power grid expertise to analyze the factors affecting the power production process and confirm the rationality of the solution.
<p>Requirement 3: Design / development solutions: under the premise of comprehensive consideration of social, health, safety, legal, cultural and environmental factors, be able to design solutions for complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields, design systems, units (components) to meet specific needs, and embody the sense of innovation in the design process.</p>	3-1. Be able to design solutions to complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields under the realistic constraints of society, health, safety, environment and law.
	3-2. Be able to design reasonable electrical control system and smart grid system according to the specific needs of users.
	3-3. Be able to complete the process design of electrical control system and power production through integrated unit process, optimize the design scheme of electrical control and smart grid, and embody the innovation consciousness.
<p>Requirement 4: Research: Based on scientific principles and by use of scientific methods, be able to study complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields, including designing experiments, analyzing and interpreting data, and obtaining reasonable and effective conclusions through information synthesis.</p>	4-1. Be able to select research route and design feasible experimental scheme based on professional theory and object characteristics.
	4-2. Based on scientific principles and scientific methods, be able to design experimental schemes, carry out experiments, analyze and interpret data for complex engineering problems related to electrical control.
	4-3. Be able to conduct researches on control system application for complex engineering problems related to electrical control and smart grid, and get reasonable and effective conclusions through information synthesis.

<p><b>Requirement 5:</b></p> <p>Use of modern tools: Be able to master the basic methods of literature retrieval, data query and using modern information technology to obtain relevant information, and be able to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for the complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields, including the prediction and simulation of complex engineering problems, and to understand their limitations.</p>	<p>5-1. Be able to master the basic methods of literature retrieval, data inquiry and using modern information technology to obtain relevant information.</p>
	<p>5-2. Be able to select and use simulation tools, human-computer interface integration tools and other technologies and resources to predict and simulate the equipment manufacturing industry and its related complex engineering problems.</p>
	<p>5-3. Be able to improve the capacity of modern tools and understand their limitations in solving complex engineering problems related to electrical control and smart grid.</p>
<p><b>Requirement 6:</b></p> <p>Engineering and society: be able to conduct reasonable analysis based on the background knowledge related to electrical control and smart grid, evaluate the impact of professional engineering practice and solutions to complex engineering problems on society, and understand the responsibilities to be undertaken; be able to study complex engineering problems based on scientific principles and scientific methods, including designing experiments, analyzing and interpreting data, and drawing reasonable and effective conclusions through information synthesis.</p>	<p>6-1. Be able to master the relevant knowledge of society, health, safety, law and culture, and be able to make reasonable analysis based on the background knowledge of electrical control system in equipment manufacturing industry and related engineering fields.</p>
	<p>6-2. Be able to grasp the connotation and significance of socialist core values, and under the guidance of correct values, be able to evaluate the impact of engineering practices and engineering schemes on society, health, safety, law and culture, and understand the responsibilities in engineering practice related to electrical control systems and solutions to complex engineering problems in equipment manufacturing industry and related engineering fields.</p>
<p><b>Requirement 7:</b></p> <p>Environment and sustainable development: Be able to understand and evaluate the impact of engineering practice for complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields on environment and social sustainable development.</p>	<p>7-1. Be able to understand and experience the impact of engineering practice for complex engineering problems related to electrical control and smart grid on environmental and social sustainable development.</p>
	<p>7-2. Be able to relevant laws and regulations to analyze and evaluate the impact of engineering practice for complex engineering problems related to electrical control and smart grid on environmental and social sustainable development.</p>
<p><b>Requirement 8:</b></p> <p>Professional norms: Be able to have a good humanities and social sciences literacy, and a sense of social responsibility, and to understand and abide by the engineering professional ethics and norms in the engineering</p>	<p>8-1. Be able to form a scientific world outlook, outlook on life and values, understand the relationship between individual and society, and understand China's national conditions.</p>
	<p>8-2. Be able to consciously abide by engineering professional ethics and norms in engineering practice, be honest and fair, code of integrity, love their posts and respect their lives.</p>

<p>practice related to electrical control system in equipment manufacturing industry and related engineering fields, and fulfill the responsibilities.</p>	<p>8-3. Be able to consciously fulfill the social responsibility for public safety, health, well-being and environmental protection in engineering practice.</p>
<p>Requirement 9: Individual and team: Be able to take on the roles of an individual, a team member and a leader in a multidisciplinary team.</p>	<p>9-1. Be able to understand the significance of teamwork, and be able to effectively communicate and cooperate with personnel in different disciplines in the R &amp; D and implementation of engineering projects.</p>
	<p>9-2. Have a good overall concept and be able to work independently or cooperatively in the team as required.</p>
	<p>9-3. Be able to organize, coordinate and lead the team to carry out work in the interdisciplinary context.</p>
<p>Requirement 10: Communication: Be able to communicate with industry peers and the public on complex engineering problems of electrical control system in equipment manufacturing and related engineering fields, including writing reports and designing documents, making statements, clearly expressing or responding to instructions, and to have a certain international vision, and to communicate in a cross-cultural background.</p>	<p>10-1. Be able to use language tools to accurately express their views and effectively communicate with peers in the industry and the public.</p>
	<p>10-2. Be able to understand international development trends and hot issues in equipment manufacturing industry and related engineering fields.</p>
	<p>10-3. Be able to understand and respect cultural differences, and be able to conduct basic communication and exchange on complex engineering issues related to electrical control and smart grid in a cross-cultural context.</p>
<p>Requirement 11: Project management: Be able to understand and master engineering management principles and economic decision-making methods, and to apply them in a multidisciplinary environment.</p>	<p>11-1. Be able to understand and master certain engineering management principles and economic decision methods.</p>
	<p>11-2. Be able to effectively analyze and comprehensively evaluate complex engineering problems related to electrical control and smart grid by using engineering management principles and economic decision-making methods.</p>
<p>Requirement 12: Lifelong learning: Be able to have the consciousness of self-learning and lifelong learning, and to have the ability of continuous learning and adapting to development.</p>	<p>12-1. Fully aware of the rapid development of electrical control and smart grid system in equipment manufacturing industry and related engineering fields, can recognize the necessity of continuous exploration and learning under the background of social development, and have the awareness of independent learning and lifelong learning..</p>
	<p>12-2. Have the ability of autonomous learning, including the ability to understand, summarize and ask questions; Be able to obtain knowledge and methods to solve problems through independent access to materials; Master language tools and computer tools for lifelong learning, and have a healthy physique and psychology to adapt to various tasks at work.</p>

## The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives			
	Educational Objectives 1	Educational Objectives 2	Educational Objectives 3	Educational Objectives 4
1: Engineering Knowledge	√			
2: Problem Analysis	√			
3: Design/Development Solutions	√			
4: Research		√		
5: Use of Modern Tools		√		
6: Engineering and Society		√		
7: Environment and Sustainable Development			√	√
8: Professional Norms			√	
9: Individual and Team			√	
10: Communication			√	√
11: Project Management			√	
12: Lifelong Learning				√

### IV. Major Subject

Electrical engineering, control engineering.

### V. Core Courses

Fundamentals of Circuit Analysis, Analog Electronic Technology, Digital Electronic Technology, Electrical Machinery Theory, Automatic Control Theory, Fundamentals of power system analysis, Power Electronics Technology of Electric Control, Power Supply of Factories, Motion Control System, Smart grid technology, Power system protection

### VI. Educational System

The basic length of undergraduate education is 4 years, and the flexible study period is 3-6 years, which is managed according to the credit system.

### VII. Confer Degrees

Students are required to obtain at least \*164.0 \* credits before graduation. The Bachelor of Engineering degree can be granted to those who meet the requirements of the Relevant Provisions on the Awarding of Bachelor's Degree for Graduates of Shenyang University of Chemical Technology (revised in March 2017).

## VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit requirement	Subtotal	Proportion (%)
General Education	General Education (Compulsory)	Ideological and Political Courses	Compulsory	17	41.5	25.30
		Foreign Language Courses		12		
		Computer Courses		2.5		
		Military and Safety Courses		2		
		Labor and Sport Education		5		
		Innovation and Entrepreneurship		2		
		Mental Health		1		
	General Education (Optional)	Aesthetic Education(400)	Optional	2	8	4.88
		China and the World(500)		2		
		Four Histories(600)		1		
		Economic Management(700)		1		
		Traditional Culture(900)		2		
	General Education (Practice)	Military Training	Practice	2	2	1.22
Discipline Education	Basic Courses	Public basic class	Compulsory	59.5	69.0	68.60
		Professional foundation				
	Basic Practice Sessions	-	Practice	9.5		
Specialized Education	Core Courses	-	Compulsory	10.5	38.5	
	Optional Courses	-	Optional	5		
	Specialized Practice Sessions	-	Practice	23		
Competency Development	Individualized Courses	-	Compulsory (or Practice)	5	5	
Extracurricular practice	Extracurricular General Education Practice	Culture and Society Practice	Extracurricular Practice	4		
		Mentally and Physically Practice				
		Foreign Language Proficiency Training Practice				
	Extracurricular Characteristic Practice	Innovative Training		4		
		Innovation Competition				
		Chuangke Activities				
	Career Education	Growth Planning Courses		1		
Total/Proportion					164.0	100

## 九、电气工程及其自动化专业教学进程表

### Table of Teaching Schedule for Electrical Engineering and Automation Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th		
通识教育课 General Education	必修 Compulsory	思政类 Ideological and Political Courses	0710093001	思想道德与法治    Cultivation of Ideological Morality and Basis of Law	3.0	48	32			16		2								
			0710053001	中国近现代史纲要   Outline of Chinese Contemporary and Modern History	3.0	48	32			16	2									
			0710103001	马克思主义基本原理*   Elementary Theory of Marxism*	3.0	48	32			16				2						
			0710133001	毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics *	3.0	48	32			16				2						
			0710123001	习近平新时代中国特色社会主义思想概论 Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8					3					
			0710012301	形势与政策   Current Situation and Policies	2.0	64	64				2	2	2	2	2	2	2	2		
	外语类 Foreign Language Courses	0211003101	大学外语I   College English I	3.0	48	48				3										
		0211003201	大学外语II   College English II	3.0	48	48					3									
		0241003301	大学外语III   College English III	3.0	48	48						3							五选 一	

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes			
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th				
通识教育课 General Education	必修 Compulsory	外语类 Foreign Language Courses	0241003301	大学外语III（进阶英语）    College English III（Advanced English CET 6-Orientated）	3.0	48	48						3									
				大学外语III（英语口语表达与交流）    College English III（English Oral Expression and Communication）	3.0	48	48								3							
				大学外语III（跨文化交际）    College English III（Intercultural Communication）	3.0	48	48								3							
				大学外语III（英语写作表达与交流）    College English III（English Writing Expression and Communication）	3.0	48	48								3							
			0241003401	大学外语IV*   College English IV*	3.0	48	48									3						
				大学外语IV（进阶英语）    College EnglishIV（Advanced English CET 6-Orientated）	3.0	48	48									3						
				大学外语IV（英语口语表达与交流）    College EnglishIV（English Oral Expression and Communication）	3.0	48	48									3						
				大学外语IV（跨文化交际）    College English IV（Intercultural Communication）	3.0	48	48									3						
				大学外语IV（英语写作表达与交流）    College English IV（English Writing Expression and Communication）	3.0	48	48									3						
				1511372002	C 语言程序设计    C Programming Language	2.5	44	32			12			2								

五选  
一





课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th		
学科平台课 Discipline Education	必修 Compulsory	数学与自然科学类 Natural Science & Mathematics	0310004101	高等数学 I*   Advanced Mathematics I*	4.5	80	72			8	6									
			0310005201	高等数学 II*   Advanced Mathematics II*	5.5	96	88			8	6									
			0310032001	线性代数    Linear Algebra	2.0	32	32				3									
			0310042001	概率论与数理统计   Probability and Statistics	2.0	32	32							2						
			1510251002	复变函数   Function of Complex Variable	1.5	24	24					2								
			1519501002	面向信息科学的离散数学   Discrete Mathematics in Information Science	1.0	16	16							2						
			0310063101	大学物理 I*   University Physics I*	3.0	48	46	2					3							
			0310063201	大学物理 II*   University Physics II*	3.0	48	46	2						3						
			1511331002	近代物理学    Modern Physics	1.0	16	16							2						
	工程基础类 Foundation Engineering			1510141002	电气工程制图及 CAD    Electrical Engineering Drawing and CAD	1.5	26	20		6		2								
				1510163002	电路分析基础*    Fundamentals of Circuit Analysis*	3.5	56	56					4							
				1510913002	模拟电子技术*    Analogue Electronic Technology*	3.5	60	48	12						3					
				1510923002	数字电子技术*    Digital Electronic Technology*	3.5	60	48	12							3				





课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th		
专业教育课 Specialized Education	必修 Compulsory		1522562002	智能电网技术    Smart Grid Technology	2.0	32	32									3				
			1522581002	新能源发电技术    New Energy Power Generation Technology	1.5	24	24										2			
			1522322002	电力系统继电保护*    Power System Relay Protection*	2.0	34	28	6									3			
			1522414002	电力系统分析基础*    Fundamentals of Electric Power System*	3.0	50	44	6						4						
			小计 Subtotal			10.5	178	148	30											
							172	160	12											
		选修 Optional		1532121002	高电压工程    High Voltage Engineering	1.0	16	16									2			
			1537042002	计算机网络与通信技术    Computer Network and Communication Technology	2.0	32	32						2							
			1532351002	微网及其控制    Microgrid and its Control	1.0	16	16										2			
			1534962002	C#程序设计    C# Program Design	2.0	36	24		12						2					
			1534302002	信号与系统II    Signals and SystemsII	2.0	34	28	6					2							
			1536252002	VB 程序设计    Visual Basic Program Design	2.0	36	24		12			2								
			1531383002	现代控制理论   Modern Control Theory	3.0	52	40	8	4						3					
			1531392002	数据库基础   Database Basis	2.0	36	24		12					2						



课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th			
专业教育课 Specialized Education	电气控制方向 Electrical Control	1512272022	PLC 系统实训    PLC System Training	2.0	48		48										+2	集中			
		1512222042	毕业设计（论文）    Graduation Design (Thesis)	14	336		336												+14	集中	
	实践 Practice	智能电网方向 Smart Grid	1512312022	电力系统继电保护课程设计    Power System Protection Course Design	2.0	48		48										+2	集中		
			1512322022	电力系统自动化课程设计    Fundamentals of Electric Power System Design	2.0	48		48							√					分散	
			1512333022	智能微网设计    Intelligent Microgrid Design	3.0	72		72								√					分散
		1512342022	新能源系统设计    Design of New Energy Power System	2.0	48		48											√		分散	
		1512222042	毕业设计（论文）    Graduation Design (Thesis)	14	336		336													+14	集中
		小计 Subtotal				23.0	552		552												
	合计 Total					38.5															
能力拓展课 Competency Development	必修或实践 Compulsory or Practice	1512242022	电机调速系统设计    Design of Motor Speed Control System	2.0	48		48											+2	集中		
		1512282022	电气工程综合实训    Comprehensive Training of Electrical Engineering	3.0	72		72												+3	集中 CDIO 课程	
		小计 Subtotal				5.0	120		120												
		（此处填写修读要求 Fill in the Study Requirements）																			

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes			
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th				
总计 Sum					164.0	2904	1582	1164	22	136	18.0	28.0	17.5	28.5	18.0	15	10	16+8			
						2898	1594	1146	22	136					13.0	18	12	+5			
课外 环节 Extracurricular practice	课外实践 Extracurricular practice	人文社会实践 Culture and Society Practice	1513401032	社会调查   Social Survey	0.5	12				12								0.5	分散		
		身心健康社会实践 Mentally and Physically Practice	0410050751	课外体育锻炼   Extracurricular Physical Exercise	0.5	12					12								0.5	分散	
			2640030011	劳动教育实践   Labour Education Practice	0.5	12					12	0.5									分散
			0510070311	心理健康辅导   Mental Health Counseling	0.5	12					12								0.5	分散	
		外语技能实践类 Foreign Language Proficiency Training Practice	0210010011	外语技能实践（初级）   Foreign Language Proficiency Training Practice (Elementary)	2.0	48					48				2						分散 二选 一
			0210020011	外语技能实践（高级）   Foreign Language Proficiency Training Practice (Advanced)	2.0	48					48				2						
		能力与创新实践 Capability and Innovation Practice	1513414022	大学生素质拓展与创新实践   Quality Development and Innovation Practice	4.0	96					96	1~8 学期依据《沈阳化工大学创新创业实践学分认定办法》由创新创业学院认定								分散	

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5，课程名称中画\*为考试课。

Note: "Cre. (Credits)", "T.C.H. (Total Credit Hours)", "Lec. (Lecture)", "Exp. (Experiment)", "Pro. (Programming)", "Pra. (Practice)".



## 十、电气工程及其自动化专业学士学位课程一览表

### A list of bachelor's degree programs in Electrical Engineering and Automation

课程类别 Course Type	模块名称 Modules	序号 No.	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester	
通识教育课 General Education	政治理论 Political Theory	1	0710103001	马克思主义基本原理* Elementary Theory of Marxism*	3	4	
		2	0710133001	毛泽东思想和中国特色社会主义理论体系概论* Mao Zedong Thought and Theory of Socialism with Chinese Characteristics I*	3	4	
学科平台课 Discipline Education	数学 Mathematics	3	0310004101	高等数学I* Advanced Mathematics I*	4.5	1	
	物理 Physics	4	0310063101	大学物理I* University Physics I*	3	2	
	工程基础 Foundations of Engineering	5	1510163002	电路分析基础* Fundamentals of Circuit Analysis*	3.5	2	
		6	1510913002	模拟电子技术* Analogue Electronic Technology*	3.5	3	
		7	1510923002	数字电子技术* Digital Electronic Technology*	3.5	4	
	专业基础 Subject Foundation Requisite	8	1512811102	电气工程及其自动化专业外语 Specialized English	1	5	
		9	1511364002	自动控制原理* The Principle of Automatic Control*	4	4	
		10	1512102002	电力电子技术* Power Electronics*	2.5	5	
		11	1512952002	电机学* Electrical Machinery Theory*	3.0	4	
		12	1512082002	工程电磁场 Engineering Electromagnetic Field	2	3	
	专业教育课 Specialized Education	电气控制 Electrical Control	13	1522732002	电气控制技术 Technology Electrical Control Technology	2.5	5
			14	1522372002	运动控制系统* Motion Control System*	2.5	6
15			1522392002	工厂供电* Power Supply of Factories*	2.5	5	
智能电网 Smart Grid		13	1522322002	电力系统继电保护* Power System Relay Protection*	2.0	6	
		14	1522414002	电力系统分析基础* Fundamentals of Electric Power System*	3.0	5	
		15	1522562002	智能电网技术 Smart Grid Technology	2.0	6	

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》

### 十一、全学程实践环节周历安排 Weekly Calendar of all Practice Sessions

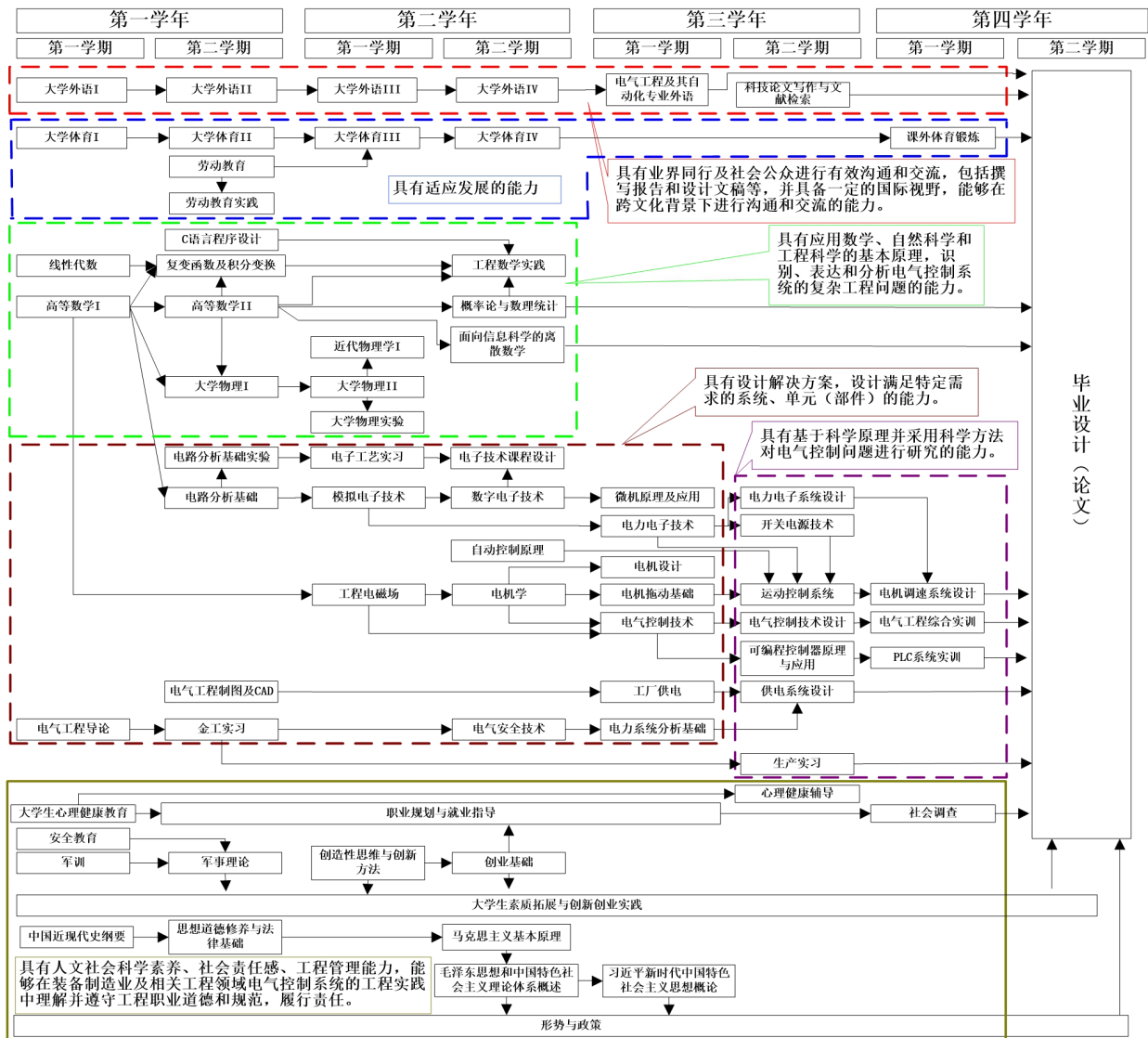
学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注
一		☆	☆															::	::	•		
二													※					::	::	•		
三																		::	::	•		
四									△									::	::	•		
五									p	p								::	::	•		
六																		::	::	•		
七	△	△	△	△	/	/												::	::	•		
八	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	::	::	•		

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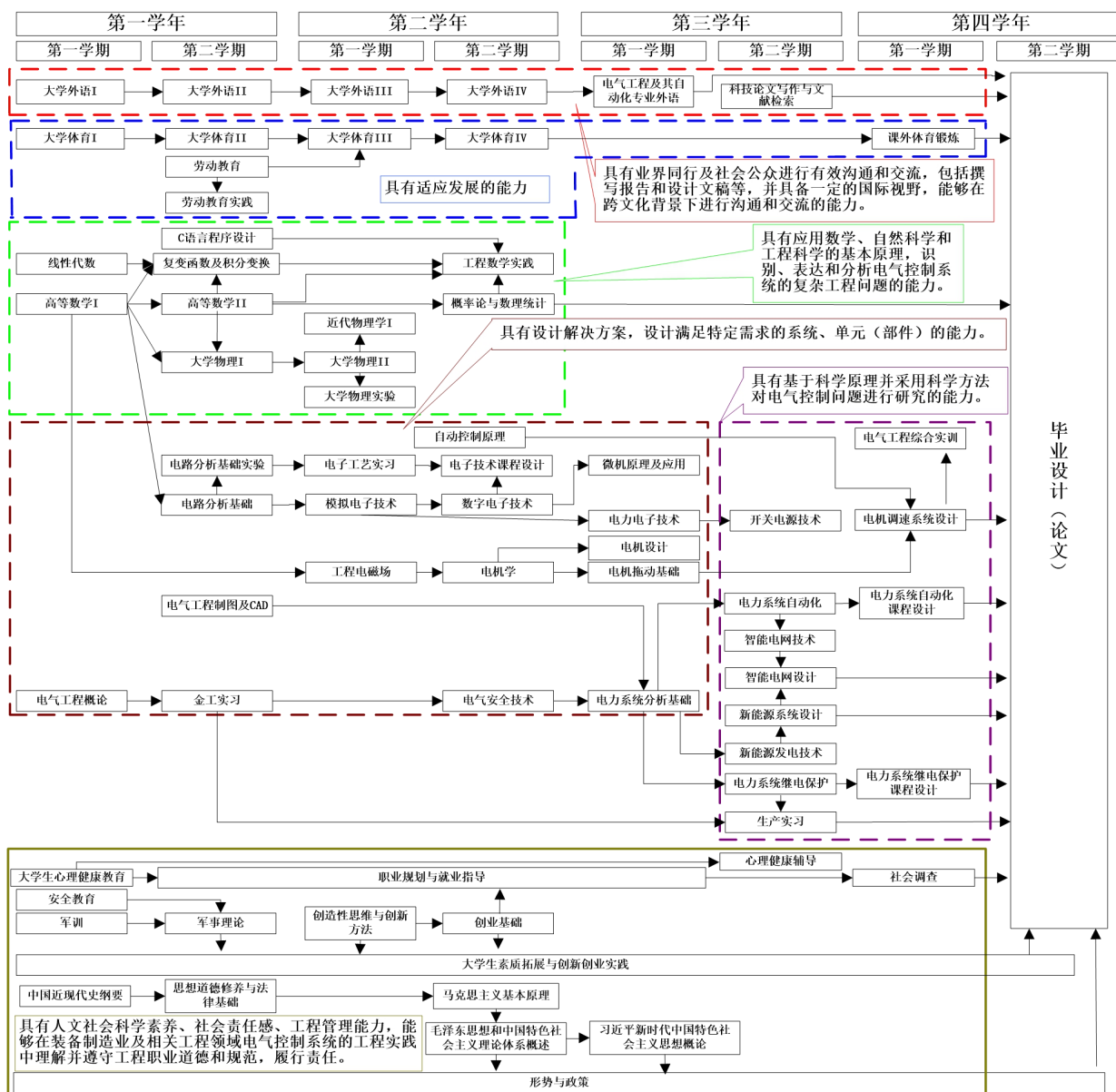
符号说明(Symbol Description):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P 各类实训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼ 认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计(论文)||Graduation Project(Thesis)    ·小学期||Primary Term

## 十二、课程体系配置图 Curriculum System Configuration Diagram



电气控制方向



### 智能电网方向

十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements ( High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																						
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	10.3	11.1	11.2	12.1	12.2					
思想道德与法治    Ideological Morality and the Rule of Law																							L	M	H														
中国近现代史纲要   Outline of Chinese Contemporary and Modern History																							M																
马克思主义基本原理*   Basic Principles of Marxism*																							M																
毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*																			M				H																
习近平新时代中国特色社会主义思想概论    Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																																							
形势与政策   Current Situation and Policies																																							
大学外语   College English																																							

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																		
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	10.3	11.1	11.2	12.1	12.2	
C 语言程序设计   C Language Programming																M																			M
军事理论   Military Theory																							M												
安全教育   Safety Education									M									M														L			
劳动教育   Labour Education																							L		L		L								
大学体育   College Physical Education																											H								M
创造性思维与创新方法   Creative Thinking and Innovative Methods																														L				L	H
创业基础   Entrepreneurial Foundation																									M	M	L		L		M				
大学生心理与健康教育   Mental and Health Education for College Students																		M					L												
军训   Military Training																							M	M			H								
高等数学*   Advanced Mathematics*	M	M		M	L																														
线性代数    Linear Algebra	M	M		M	L																														
概率论与数理统计   Probability and Statistics	M				L				L																										







课程 (Courses)	毕业能力要求 (Graduation Requirements)																																				
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	10.3	11.1	11.2	12.1	12.2			
可编程控制器原理与应用   The Principle and Application of Programmable Controller				M						L																											
运动控制系统*   Motion Control System*			M	H								M		L																							
开关电源技术   Switching Power Supply Technology				L						M																											
工厂供电*   Power Supply of Factories*										M																								M			
电机设计   Design of Electrical Machine					L							M																									
电力系统分析基础*   Fundamentals of Electric Power System*					H																													M			
电力电子系统设计   Design of Power Electronic System										M			L														M										
供电系统设计   Power Supply System Design									M		M																								L		
电气控制技术设计   Design of Electrical Control Technology							L						L						M			L												M			
PLC 系统实训   PLC System Training											L		M				M																			M	
毕业设计 (论文)   Graduation Design (Thesis)							H		M					M			H					M						M	M					M		M	
电机调速系统设计   Design of Motor Speed Control System									M					M													M										
电气工程综合实训   Comprehensive Training of Electrical Engineering									M					H			M		M																		



课程 (Courses)	毕业能力要求 (Graduation Requirements)																																			
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	10.3	11.1	11.2	12.1	12.2		
社会调查   Social Survey															L										M											
课外体育锻炼   Extracurricular Physical Exercise																					L			L												M
职业规划与就业指导   Career Planning and Employment Guidance																								L	M											



# 沈阳化工大学本科培养方案

## 信息工程学院

专业名称：电子信息工程

专业代码：080701

制 定：陈 斌

审 核：孔晓光

审 定：于三三

批 准：金志浩

2021年8月

# 电子信息工程专业培养方案

## 一、培养目标

培养能在电子信息领域从事电子设备和信息系统的分析、设计、开发、运维及管理工作的德智体美劳全面发展的高素质应用型工程技术人才，成为自觉服务国家和社会的社会主义事业合格建设者和可靠接班人。

本专业毕业生在毕业后 5 年左右：

(1) 具有熟练运用工程数理知识和电子信息专业知识解决电子信息领域的电子设备及信息系统等工程项目的能力，成为电子信息领域工程师、技术骨干等；

(2) 具有运用现代工具和先进技术对电子信息领域的电子设备及信息系统进行创新性分析、设计、集成和服务的能力；

(3) 具有正确的世界观和人生观，具备有效的沟通、表达能力及项目管理能力，有良好的团队协作精神，能在工程实践中综合考虑法律、环境、社会、经济等方面因素；

(4) 具有广阔的国际视野，主动适应不断变化的国内外形势和环境，具备终生学习的能力，能够胜任不断发展的电子信息技术领域工作。

## 二、专业方向

信号处理与信息集成方向。

## 三、毕业要求

根据本专业人才培养目标以及我校电子信息工程学科多年的人才培养经验，从适应社会发展的需求出发，明确现阶段本专业的毕业能力要求及其指标点分解：

毕业能力要求	指标点
毕业要求 1： 工程知识：具备数学、自然科学、工程基础和 信息获取、传输、处理和集成相关的专业知识， 能够运用其理论和方法解决电子信息领域电子 设备和信息系统相关的复杂工程问题。	1-1. 能运用数学、自然科学、工程基础的知识，发现并表述电子信息领域的工程问题。
	1-2. 能针对电子信息领域的具体对象建立数学模型并求解。
	1-3. 能够将电子信息领域专业知识和数学模型方法用于推演、分析电子信息领域专业工程问题。
	1-4. 能够综合运用数学、自然科学、工程基础和专业知识解决电子信息领域的复杂工程问题，并对解决方案进行比较和综合。
毕业要求 2： 问题分析：能够应用数学、自然科学和工程科 学的基本原理，识别、表达、并通过文献研究 来分析电子信息领域电子设备和信息系统相关 的复杂工程问题，以获得有效结论。	2-1. 运用数学、自然科学和工程科学的基本原理，识别和判断电子信息领域电子设备和信息系统相关的复杂工程问题中的关键环节。
	2-2. 能根据电子信息基础原理和数学模型方法正确表达电子信息领域电子设备和信息系统相关的复杂工程问题。
	2-3. 能通过文献研究寻求问题的解决方案，能运用工程基础和专业基础知识，借助文献研究来分析电子信息领域电子设备和信息系统相关复杂工程过程的影响因素，寻求并获得有效结论。
毕业要求 3： 设计/开发解决方案：在综合考虑社会、健康、	3-1. 掌握电子信息领域工程设计和产品开发全周期、全流程的基本设计/开发方法和技术，了解影响设计目标和技术方案的各种因素，并能够进行系统设计。

安全、法律、文化以及环境等因素的前提下，能够针对电子信息领域电子设备和信息系统相关的复杂工程问题设计解决方案，设计满足特定需求的系统、单元（部件），并能够在设计环节中体现创新意识。	3-2. 能够设计满足特定需求的系统、单元（部件）。
	3-3. 能够在设计中考虑社会、健康、安全、法律、文化及环境等制约因素，并体现创新意识。
毕业要求 4： 研究：能够基于科学原理，采用科学方法对电子信息领域电子设备和信息系统相关的复杂工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。	4-1. 能够基于科学原理，通过文献研究或相关方法，调研和分析电子信息领域复杂工程问题的解决方案。
	4-2. 能够根据电子信息领域对象的特征，选择研究路线并设计可行的实验方案，采用科学的实验方法，合理规范地进行实验并获取数据。
	4-3. 能对实验结果进行分析和解释，并通过信息综合得到合理有效的结论。
毕业要求 5： 使用现代工具：能够针对电子信息领域电子设备和信息系统相关的复杂工程问题，具有开发、选择与使用恰当技术、资源、现代工程工具和信息技术工具进行工程实践的能力，包括对复杂工程问题的预测与模拟，并理解其局限性。	5-1. 具备计算机、网络及现代工程工具的知识，了解现代仪器仪表、建模和软件开发工具、EDA 仿真及设计等信息技术工具的使用原理和方法，并理解其局限性。
	5-2. 能够开发、选择与使用恰当的技术、仪器设备、信息资源、建模和软件开发工具、EDA 仿真及设计等现代工程和信息技术工具，对复杂工程问题分析、设计、研究、模拟与预测，并能够分析其局限性。
毕业要求 6： 工程与社会：能够基于电子信息相关背景知识进行合理分析，评价专业工程实践和电子信息领域复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。	6-1. 了解电子信息领域的技术标准体系、知识产权、产业政策和法律法规，理解不同社会文化对电子信息领域工程的影响。
	6-2. 能够分析和评价电子信息领域工程实践对社会、健康、安全、法律、文化的影响，以及这些制约因素对工程的影响，并理解应承担的责任。
毕业要求 7： 环境和可持续发展：能够理解和评价针对电子信息领域电子设备和信息系统相关的复杂工程问题工程实践对环境、社会可持续发展的影响。	7-1. 知晓和理解环境保护和可持续发展的理念和内涵。
	7-2. 能够站在环境保护和可持续发展的角度考虑电子信息领域工程实践的可持续性，评价电子信息领域工程全周期中可能对人类和环境造成的损害和隐患。
毕业要求 8： 职业规范：具有人文社会科学素养、社会责任感，能够在电子信息领域的工程实践中理解并遵守工程职业道德和规范，履行责任。	8-1. 具有正确的世界观、价值观、人生观，具有良好的人文社会科学素养、社会责任感，了解中国国情。
	8-2. 理解诚实公正、诚信守则的工程师工程职业道德和规范，理解对公众安全、健康和福祉以及环境保护的社会责任，并能在电子信息领域工程实践中遵守并承担责任。
毕业要求 9： 个人和团队：能够在具有多学科背景和多方利益诉求的项目团队中承担个体、团队成员以及负责人的角色，理解冲突、妥协与协作。	9-1. 在多学科背景工程实践团队中，能够和多学科成员沟通共事，能够独立或合作完成相应的任务。
	9-2. 在多学科背景工程实践中，理解团队成员与负责人的角色，能够组织、协调和指挥团队开展工作。
毕业要求 10： 沟通：能够就电子信息领域复杂工程问题与业界同行及社会公众进行有效沟通和交流，包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。并具备国际视野，能够在跨文化背景下进行沟通和交流。	10-1. 能够就电子信息领域专业问题与业界同行和社会公众，以口头、文稿、图表等方式进行有效的交流，理解与业界同行和社会公众交流的差异性。
	10-2. 了解电子信息领域的国际发展趋势、研究热点，具有国际化视野和外语交流能力，理解和尊重不同文化的差异性和多样性，能够在跨文化背景下进行沟通和交流。
毕业要求 11： 项目管理：理解并掌握工程管理原理与经济决策方法，并能在多学科环境中应用。	11-1. 理解并掌握工程项目中涉及的管理与经济决策方法，理解工程及产品全周期、全流程成本构成，及其涉及的工程管理及经济决策问题。
	11-2. 能够应用工程管理原理与经济决策方法对电子信息领域复杂工程问题进行有效分析和综合评价

	价, 提出经济、合理的解决方案。
毕业要求 12: 终身学习: 具有自主学习和终身学习的意识, 有不断学习和适应发展的能力。	12-1. 能够对自我探索和终身学习的必要性有正确认识, 具有自主学习的意识。 12-2. 具有自主学习的能力, 包括对技术问题的理解能力、归纳总结的能力和提出问题的能力等。

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。

### 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标			
	培养目标 1	培养目标 2	培养目标 3	培养目标 4
1: 工程知识	√			
2: 问题分析	√			
3: 设计/开发解决方案	√	√		
4: 研究		√		
5: 使用现代工具		√		
6: 工程与社会		√	√	
7: 环境和可持续发展			√	
8: 职业规范			√	
9: 个人和团队			√	
10: 沟通			√	√
11: 项目管理		√	√	√
12: 终身学习				√

## 四、主干学科

信息与通信工程

## 五、专业核心课程

电路分析基础、模拟电子技术、数字电子技术、信号与系统、数字信号处理、通信原理、高频电子与通信电路、信息论与编码、电磁场与电磁波、计算机网络、计算机组成原理。

## 六、修业年限

本科基本学制 4 年, 弹性学习年限 3-6 年, 按照学分管理制度管理。

## 七、授予学位

学生应至少修满 165.5 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者, 可授予工学学士学位。



## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例 (%)
通识教育课	通识教育必修课	思政类	必修	17	41.5	25.1
		外语类		12		
		计算机类		2.5		
		军事安全类		2		
		劳动体育类		5		
		创新创业类		2		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	2	8	4.8
		中国与世界(500)		2		
		四史(600)		1		
		经济管理类(700)		1		
传统文化(900)		2				
通识教育实践课	军训	实践	2	2	1.2	
学科平台课	学科基础课程	公共基础类	必修	73	73	68.9
		专业基础类				
	学科实践课程	-	实践			
专业教育课	专业核心课程	-	必修	11.5	35.5	
	专业选修课程	-	选修	4		
	专业实践课程	-	实践	20		
能力拓展课	专业特色课程	-	必修(或实践)	5.5	5.5	
课外实践环节	课外通识实践	人文社会实践	课外实践	4		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
	生涯教育	成长规划类		1		
总学分/比例					165.5	100%



# Electronic Information Engineering Major 2021 Undergraduate Education Program

## I. Educational Objectives

Cultivate high-quality applied engineering and technical talents who can be engaged in the analysis, design, development, operation and maintenance and management of electronic equipment and information systems in the field of electronic information, and become a person that consciously serves the country and society. Qualified builders and reliable successors of the socialist cause.

About 5 years after graduation from this major:

(1) Have the ability to use engineering mathematical knowledge and electronic information expertise to solve engineering projects such as electronic equipment and information systems in the electronic information field, and become engineers and technical backbones in the electronic information field;

(2) Have the ability to use modern tools and advanced technology to perform innovative analysis, design, integration and service of electronic equipment and information systems in the field of electronic information;

(3) Have a correct outlook on the world and life, and have effective communication, Ability to express and project management, have a good teamwork spirit, and be able to comprehensively consider legal, environmental, social, economic and other factors in engineering practice;

(4) Have a broad international perspective, and actively adapt to changing domestic and foreign Environment, with the ability of lifelong learning, capable of working in the evolving field of electronic information technology.

## II. Major direction

Signal processing and information integration direction.

## III. Graduation Requirements

According to the training objectives of this major and the many years of talent training experience in the electronic information engineering discipline of our school, starting from the needs of adapting to social development, it is clear that the graduation ability requirements and index points of this major at this stage are broken down:

Graduates should obtain knowledge and competences as follows:

Graduation Requirements	Indices
Requirement 1: Engineering knowledge: possess professional knowledge related to mathematics, natural sciences, engineering foundation and information acquisition, transmission, processing and integration, and be able to use its theories and methods to solve complex	1-1. Can use basic knowledge of mathematics, natural sciences, and engineering to discover and express engineering problems in the field of electronic information.
	1-2. It can establish mathematical models and solve specific objects in the field of electronic information.
	1-3. Be able to use professional knowledge and mathematical model methods in the field of electronic information to derive and analyze professional engineering problems in the field of electronic information.

<p>engineering problems related to electronic equipment and information systems in the field of electronic information.</p>	<p>1-4. Able to comprehensively use mathematics, natural sciences, engineering foundations and professional knowledge to solve complex engineering problems in the field of electronic information, and compare and synthesize solutions.</p>
<p>Requirement 2: Problem analysis: Be able to apply the basic principles of mathematics, natural sciences and engineering sciences to identify, express, and analyze complex engineering issues related to electronic equipment and information systems in the field of electronic information through literature research to obtain effective conclusions.</p>	<p>2-1. Use the basic principles of mathematics, natural sciences and engineering sciences to identify and judge the key links in complex engineering problems related to electronic equipment and information systems in the electronic information field.</p>
	<p>2-2. Can correctly express complex engineering problems related to electronic equipment and information systems in the field of electronic information according to the basic principles of electronic information and mathematical model methods.</p>
	<p>2-3. Can find solutions to problems through literature research, use engineering foundation and professional knowledge, and use literature research to analyze the influencing factors of electronic equipment and information systems related complex engineering processes in the electronic information field, and seek and obtain effective conclusions.</p>
<p>Requirement 3: Design/development solutions: Under the premise of comprehensively considering social, health, safety, legal, cultural and environmental factors, we can design solutions to complex engineering problems related to electronic equipment and information systems in the electronic information field, and design systems and units (components) that meet specific needs , And can reflect the sense of innovation in the design process.</p>	<p>3-1. Master the basic design/development methods and technologies of the entire cycle and process of engineering design and product development in the field of electronic information, understand various factors that affect design goals and technical solutions, and be able to design systems.</p>
	<p>3-2. Able to design systems and units (components) that meet specific needs.</p>
	<p>3-3. Be able to consider social, health, safety, legal, cultural and environmental constraints in the design, and reflect the sense of innovation.</p>
<p>Requirement 4: Research: Be able to study complex engineering issues related to electronic equipment and information systems in the field of electronic information based on scientific principles and scientific methods, including designing experiments, analyzing and interpreting data, and obtaining reasonable and effective conclusions through information synthesis.</p>	<p>4-1. Be able to investigate and analyze solutions to complex engineering problems in the field of electronic information based on scientific principles and through literature research or related methods.</p>
	<p>4-2. Able to select research routes and design feasible experimental programs according to the characteristics of objects in the electronic information field, adopt scientific experimental methods, conduct experiments in a reasonable and standardized manner, and obtain data.</p>
	<p>4-3. Be able to analyze and interpret experimental results, and obtain reasonable and effective conclusions through information synthesis.</p>
<p>Requirement 5: Use modern tools: Able to address complex engineering problems related to electronic equipment and information systems in the electronic information field, and have the ability to develop,</p>	<p>5-1. Have knowledge of computers, networks and modern engineering tools, understand the principles and methods of information technology tools such as modern instrumentation, modeling and software development tools, EDA simulation and design, and understand their limitations.</p>

<p>select and use appropriate technologies, resources, modern engineering tools and information technology tools for engineering practice, including the prediction and simulation of complex engineering problems, And understand its limitations.</p>	<p>5-2. Be able to develop, select and use appropriate technology, equipment, information resources, modeling and software development tools, EDA simulation and design and other modern engineering and information technology tools to analyze, design, research, simulate and predict complex engineering problems, and Be able to analyze its limitations.</p>
<p>Requirement 6: Engineering and society: Be able to conduct a reasonable analysis based on the background knowledge of electronic information, evaluate the impact of professional engineering practices and complex engineering problem solutions in the field of electronic information on society, health, safety, law, and culture, and understand the responsibilities that should be undertaken.</p>	<p>6-1. Understand the technical standard system, intellectual property rights, industrial policies, laws and regulations in the field of electronic information, and understand the impact of different social cultures on projects in the field of electronic information.</p> <p>6-2. Be able to analyze and evaluate the impact of engineering practices in the field of electronic information on society, health, safety, law, and culture, as well as the impact of these constraints on the project, and understand the responsibilities that should be undertaken.</p>
<p>Requirement 7: Environment and sustainable development: Able to understand and evaluate the impact of engineering practice on the sustainable development of the environment and society for complex engineering problems related to electronic equipment and information systems in the electronic information field.</p>	<p>7-1. Know and understand the concepts and connotations of environmental protection and sustainable development.</p> <p>7-2. Be able to consider the sustainability of engineering practices in the field of electronic information from the perspective of environmental protection and sustainable development, and evaluate the damage and hidden dangers that may be caused to humans and the environment during the full cycle of engineering in the field of electronic information.</p>
<p>Requirement 8: Professional norms: Possess humanities and social science literacy, a sense of social responsibility, and be able to understand and abide by engineering professional ethics and norms in the field of electronic information engineering practice, and perform responsibilities.</p>	<p>8-1. Have a correct world outlook, values, outlook on life, good humanities and social science literacy, a sense of social responsibility, and an understanding of China's national conditions.</p> <p>8-2. Understand the engineering professional ethics and norms of honesty, fairness and integrity, understand the social responsibility for public safety, health and well-being, and environmental protection, and be able to comply with and assume responsibilities in engineering practices in the field of electronic information.</p>
<p>Requirement 9: Individuals and teams: Able to assume the roles of individuals, team members and leaders in a project team with a multi-disciplinary background and multi-party interest appeals, and understand conflicts, compromises and collaborations.</p>	<p>9-1. In a multi-disciplinary engineering practice team, able to communicate and work with multi-disciplinary members, and be able to complete corresponding tasks independently or cooperatively.</p> <p>9-2. In engineering practice with a multi-disciplinary background, understand the roles of team members and leaders, and be able to organize, coordinate, and direct team work.</p>
<p>Requirement 10: Communication: Able to effectively communicate and communicate with industry colleagues and the public on</p>	<p>10-1. Be able to communicate effectively with industry colleagues and the public on professional issues in the field of electronic information, through oral, manuscript, and diagrams, and understand the differences in communication with industry colleagues and the public.</p>

complex engineering issues in the field of electronic information, including writing reports and design manuscripts, making statements, expressing clearly or responding to instructions. And have an international perspective, able to communicate and exchange in a cross-cultural context.	10-2. Understand the international development trends and research hotspots in the field of electronic information, have an international vision and the ability to communicate in foreign languages, understand and respect the differences and diversity of different cultures, and be able to communicate and communicate in a cross-cultural context.
Requirement 11: Project management: Understand and master engineering management principles and economic decision-making methods, and be able to apply them in a multi-disciplinary environment.	11-1. Understand and master the management and economic decision-making methods involved in engineering projects, understand the cost composition of the whole cycle and the whole process of engineering and products, and the engineering management and economic decision-making issues involved.
	11-2. Ability to apply engineering management principles and economic decision-making methods to effectively analyze and comprehensively evaluate complex engineering problems in the field of electronic information, and to propose economic and reasonable solutions.
Requirement 12: Lifelong learning: Have the consciousness of independent learning and lifelong learning, and have the ability to continuously learn and adapt to development.	12-1. Able to have a correct understanding of the necessity of self-exploration and lifelong learning, and have the consciousness of independent learning.
	12-2. Have the ability to learn independently, including the ability to understand technical problems, the ability to summarize and ask questions, etc.

### The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives			
	Educational Objectives 1	Educational Objectives 2	Educational Objectives 3	Educational Objectives 4
1: Engineering Knowledge	√			
2: Problem Analysis	√			
3: Design/Development Solutions	√	√		
4: Research		√		
5: Use Modern Tools		√		
6: Engineering and Society		√	√	
7: Environment and Sustainable Development			√	
8: Career Planning			√	
9: Individuals and Teams			√	
10: Communicate			√	√
11: Project Management		√	√	√
12: Lifelong Learning				√

#### **IV. Major Subject**

Information and Communication Engineering

#### **V. Core Courses**

Basis of Circuit Analysis, Analog Electronic Technology, Digital Electronic Technology, Signals and Systems, Digital Signal Processing, Principles of Communication, High Frequency Electronics and Communication Circuits, Information Theory and Coding, Electromagnetic Field and Electromagnetic Wave, Computer Networks, Principle of Computer Organization.

#### **VI. Educational System**

The basic school system for undergraduates is 4 years, and the flexible study period is 3-6 years, which is managed in accordance with the credit system.

#### **VII. Confer Degrees**

Students should take at least 165.5 credits to graduate. Those who meet the requirements for degree granting in the "Shenyang University of Chemical Technology undergraduate graduates' bachelor's degree award work regulations (revised in March 2017)" can be awarded a bachelor's degree in engineering.

## VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit requirement	Subtotal	Proportion (%)
General Education	General Education (Compulsory)	Ideological and Political Courses	Compulsory	17	41.5	25.1
		Foreign Language Courses		12		
		Computer Courses		2.5		
		Military and Safety Courses		2		
		Labor and Sport Education		5		
		Innovation and Entrepreneurship		2		
		Mental Health		1		
	General Education (Optional)	Aesthetic Education(400)	Optional	2	8	4.8
		China and the world(500)		2		
		Four Histories(600)		1		
		Economic Management(700)		1		
		Traditional Culture(900)		2		
	General Education (Practice)	Military Training	Practice	2	2	1.2
Discipline Education	Basic Courses	Public basic class	Compulsory	73	73	
		Professional foundation				
	Basic Practice Sessions	-	Practice			
Specialized Education	Core Courses	-	Compulsory	11.5	35.5	68.9
	Optional Courses	-	Optional	4		
	Specialized Practice Sessions	-	Practice	20		
Competency Development	Individualized Courses	-	Compulsory (or Practice)	5.5	5.5	
Extracurricular practice	Extracurricular General Education Practice	Culture and Society Practice	Extracurricular Practice	4		
		Mentally and Physically Practice				
		Foreign Language Proficiency Training Practice				
	Extracurricular Characteristic Practice	Innovative Training		4		
		Innovation Competition				
		Maker Activities				
	Career Education	Growth Planning Courses		1		
Total/Proportion					165.5	100



## 九、电子信息工程专业教学进程表

### Table of Teaching Schedule for Electronic Information Engineering Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
通识教育课 General Education	必修 Compulsory	思政类 Ideological and Political Courses	0710093001	思想道德与法治    Ideological Morality and the Rule of Law	3.0	48	32			16		2								
			0710053001	中国近现代史纲要    Outline of Chinese Contemporary and Modern History	3.0	48	32			16	2									
			0710103001	马克思主义基本原理*    Basic Principles of Marxism*	3.0	48	32			16				2						
			0710133001	毛泽东思想和中国特色社会主义理论体系概论*    Mao Zedong Thought and Theory of Socialism with Chinese Characteristics *	3.0	48	32			16				2						
			0710123001	习近平新时代中国特色社会主义思想概论    Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8					3					
			0710012301	形势与政策    Current Situation and Policies	2.0	64	64				2	2	2	2	2	2	2	2		
	外语类 Foreign Language Courses	0211003101	大学外语I    College English I	3.0	48	48				3										
		0211003201	大学外语II*    College English II*	3.0	48	48					3									
		0241003301	大学外语III    College English III	3.0	48	48						3							五选一	

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
通识教育课 General Education	必修 Compulsory	外语类 Foreign Language Courses	0241003301	大学外语III（进阶英语）    College English III（Advanced English CET 6-Orientated）	3.0	48	48						3							
				大学外语III（英语口语表达与交流）    College English III（English Oral Expression and Communication）	3.0	48	48							3						
				大学外语III（跨文化交际）    College English III（Intercultural Communication）	3.0	48	48							3						
				大学外语III（英语写作表达与交流）    College English III（English Writing Expression and Communication）	3.0	48	48							3						
			0241003401	大学外语IV*   College English IV*	3.0	48	48								3					
				大学外语IV（进阶英语）    College EnglishIV（Advanced English CET 6-Orientated）	3.0	48	48									3				
				大学外语IV（英语口语表达与交流）    College EnglishIV（English Oral Expression and Communication）	3.0	48	48										3			
				大学外语IV（跨文化交际）    College English IV（Intercultural Communication）	3.0	48	48											3		
		计算机类 Computer Courses	1511372002	C 语言程序设计   C Programming Language	2.5	44	32			12				2						

五选一

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
通识教育课 General Education	必修 Compulsory	军事安全类 Military and Safety Courses	0710081001	军事理论   Military Theory	1.0	16						2								
			1510261302	安全教育   Safety Education	1.0	16	16					1	1	1	1	1	1	1		
		劳动体育类 Labor and Sport Education	2640021001	劳动教育   Labour Education	1.0	16	16						2							
			0410011101	大学体育I   College Physical Education I	1.0	36		36				2								
			0410021201	大学体育II   College Physical Education II	1.0	36		36					2							
			0410031301	大学体育III   College Physical Education III	1.0	36		36						2						
			0410041401	大学体育 IV   College Physical Education IV	1.0	36		36							2					
			创新创业类 Innovation and Entrepreneurship courses	1557011002	创造性思维与创新方法   Creative Thinking and Innovative Methods	1.0	16	16							2					
		1740011001		创业基础   Entrepreneurial Foundation	1.0	16	16								2					
		心理健康类 Mental Health Courses	0510041001	大学生心理与健康教育   Mental and Health Education for College Students	1.0	16	16					2								
		小计 Subtotal					41.5	780	552	144	12	72								
			选修 Optional	分为经济管理类（1.0）、美育类（2.0）、四史（1.0）、传统文化（2.0）、中国与世界（2.0）课程类5个模块 每个模块最多选修2.0学分，每学期最多选修2门课程。 Including 5 modules: Economic Management（1.0）, Aesthetic Education（2.0）, Four Histories（1.0）, Traditional Chinese Culture（2.0）, China and The world（2.0）. Up to 2.0 credits per module and up to 2 courses per semester.																

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八			
											1st	2nd	3rd	4th	5th	6th	7th	8th			
通识教育课 General Education			小计 Subtotal		8.0	128	128														
	实践 Practice		0415102011	军训   Military Training	2.0	48				48	+2								集中		
合计 Total					51.5	956	680	144	12	120											
学科平台课 Discipline Education	必修 Compulsory	数学与自然科学类 Natural Science & Mathematics	0310004101	高等数学 I*   Advanced Mathematics I*	4.5	80	72			8	6										
			0310005201	高等数学 II*   Advanced Mathematics II*	5.5	96	88			8		6									
			0310032001	线性代数    Linear Algebra	2.0	32	32					3									
			0310042001	概率论与数理统计   Probability and Statistics	2.0	32	32							2							
			1510251002	复变函数   Function of Complex Variable	1.5	24	24						2								
			1519501002	面向信息科学的离散数学   Discrete Mathematics in Information Science	1.0	16	16							2							
			0310063101	大学物理 I*   University Physics I*	3.0	48	46	2					3								
			0310063201	大学物理 II*   University Physics II*	3.0	48	46	2						3							
		1111042003	化学工艺学   Chemical Process Technology	1.0	16	16								2							
				工程基础类 Foundation Engineering	1510141002	电气工程制图及 CAD   Electrical Engineering Drawing and CAD	1.5	26	20				6			2					
		1510163002	电路分析基础*    Basis of Circuit Analysis*		3.5	56	56							4							

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes				
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八					
											1st	2nd	3rd	4th	5th	6th	7th	8th					
学科平台课 Discipline Education	必修 Compulsory	工程基础类 Foundation Engineering	1510913002	模拟电子技术*   Analog Electronic Technology*	3.5	60	48	12				3											
			1510923002	数字电子技术*   Digital Electronic Technology*	3.5	60	48	12					3										
			1514822002	电磁场与电磁波*   Electromagnetic Field and Electromagnetic Wave*	2.0	32	32						2										
			1514883002	信号与系统 I*   Signals and Systems I*	3.0	50	44	6					4										
	专业基础类 Subject Foundation Requisite			1514811002	电子信息工程专业概论   Introduction to Electronic Information Engineering	1.0	16	16				2											
				1514892002	数字信号处理*   Digital Signal Processing*	2.5	42	36	6				3										
				1514902002	高频电子与通信电路*   High Frequency Electronics and Communication Circuits*	2.5	42	36	6								3						
				1514832002	信息论与编码*   Information Theory and Coding*	2.0	32	32									2						
				1517122002	通信原理 I*   Principles of Communication I*	2.5	42	36	6							3							
				1513272002	算法与数据结构   Algorithm and Data Structure	2.5	44	32		12				3									
				1514922002	数据库原理与应用   Principle and Application of Database	2.0	36	24		12						3							
				1517062002	计算机网络*   Computer Networks*	2.5	44	32		12							2						
				1526982002	计算机组成原理*    Principle of Computer Organization*	2.5	42	36	6							3							



课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八			
										1st	2nd	3rd	4th	5th	6th	7th	8th			
合计 Total				73.0	1300	938	304	42	16											
专业教育课 Specialized Education	必修 Compulsory	1524932002	面向对象程序设计   Object-oriented Programming	2.0	36	24		12					3							
		1524482002	Python 机器学习   Python Machine Learning	2.5	48	24		24							2					
		1513822002	单片机原理与应用   The Application and Principal of MCU	2.5	44	32	12								3					
		1514662002	化工过程信息处理与传输   Chemical Process Information Processing and Transmission	2.0	32	32											2			
		1524942002	数字信号处理器原理及应用   Principle and Application of Digital Signal Processors	2.5	44	32	12										3			
		小计 Subtotal				11.5	204	144	24	36										
	选修 Optional	1536972002	嵌入式系统原理    Embedded System Principle	2.0	36	24	12									2				
		1534872002	语音信号处理   Speech Signal Processing	2.0	36	24		12							2					
		1537242002	Matlab 程序设计   Matlab Programming	2.0	36	24		12				2								
		1534962002	C#程序设计   C# Programming	2.0	36	24		12							2					
		1534863002	大数据原理与技术   Principle and Technology of Big Data	3.0	56	32		24									4			

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
										1st	2nd	3rd	4th	5th	6th	7th	8th		
专业教育课 Specialized Education	选修 Optional	1533912002	FPGA 原理及设计   Principle and Design of FPGA	2.0	36	24	12							2					
		1534842002	Python 数据分析与应用   Python Data Analysis and Application	2.0	36	24		12				2							
		1538563002	ZigBee 技术应用及无线传感器网络   ZigBee Technology Application and Wireless Sensor Networks	3.0	52	40	12								3				
		1537073002	移动通信   Mobile Communication	3.0	52	40	12									3			
		1531552002	自动控制原理II   The Principle of Automatic Control II	2.0	34	28	6					2							
		小计 Subtotal				4.0													
	( 修读要求 4 学分, Study Requirements 4 Credits )																		
	实践 Practice	1514522022	信号处理课程设计   Course design of Signal Processing	2.0	48		48											+2	集中
		1514551022	数字信号处理器课程设计   Course Design of Digital Signal Processor	1.0	24		24											+1	集中
		1514531022	程序实践   The Practice of Programming	1.0	24		24							√					分散
		1514152032	生产实习   Production Practice	2.0	48		48											+2	集中
		1514971042	毕业设计 ( 论文 )   Graduation Design ( Thesis )	14.0															+17
小计 Subtotal				20.0	144		144												



课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
合计 Total					36.5															
能力拓展课 Competency Development	必修或实践 Compulsory or Practice		1524852002	数字图像处理*   Digital Image Processing*	2.5	44	32	12								3				
			1514563022	信息系统集成综合设计   Information System Integration Comprehensive Design	3.0	72		72										+3	集中 CDIO 课程	
			小计 Subtotal		5.5	116	32	84												
			总计 Sum																	
课外环节 Extracurricular practice	课外实践 Extracurricular practice	人文社会实践 Culture and Society Practice	1513401032	社会调查   Social Survey	0.5	12				12								0.5	分散	
		身心健康社会实践 Mentally and Physically Practice	0410050751	课外体育锻炼   Extracurricular Physical Exercise	0.5	12				12								0.5	分散	
			2640030011	劳动教育实践   Labour Education Practice	0.5	12				12	0.5								分散	
			0510070311	心理健康辅导   Mental Health Counseling	0.5	12				12								0.5	分散	
		外语技能实践类 Foreign Language Proficiency Training Practice	0210010011	外语技能实践（初级）   Foreign Language Proficiency Training Practice (elementary)	2.0	48				48				2						二选一
			0210020011	外语技能实践（高级）   Foreign Language Proficiency Training Practice (advanced)	2.0	48				48				2						

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
课外环节 Extracurricular practice	课外实践 Extracurricular practice	能力与创新实践 Capability and Innovation Practice	1513414022	大学生素质拓展与创新实践   Quality Development and Innovation Practice	4.0	96					1~8 学期依据《沈阳化工大学创新创业实践学分认定办法》由创新创业学院认定								分散	
		成长规划类 Growth Planning Courses	1510271312	职业规划与就业指导   Career Planning and Employment Guidance	1.0	40	40													
小计 Subtotal																				

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5,课程名称中画\*为考试课。

Note: “Cre. (Credits)”, “T.C.H. (Total Credit Hours)”, “Lec. (Lecture)”, “Exp. (Experiment)”, “Pro. (Programming)”, “Pra. (Practice)”.

## 十、电子信息工程专业学士学位课程一览表

### A list of bachelor's degree programs in Electronic Information Engineering

课程类别 Course Type	模块名称 Modules	序号 No.	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester	
通识教育课 General Education	政治理论 Political Theory	1	0710103001	马克思主义基本原理*    Basic Principles of Marxism*	3	4	
		2	0710133001	毛泽东思想和中国特色社会主义理论体系 概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3	4	
学科平台课 Discipline Education	数学 Mathematics	3	0310004101	高等数学I*   Advanced Mathematics I*	4.5	1	
	物理 Physics	4	0310063101	大学物理 I*   University Physics I*	3	2	
	工程基础类 Foundations of Engineering	5	1510163002	电路分析基础*    Basis of Circuit Analysis*	3.5	2	
		6	1510913002	模拟电子技术*   Analog Electronic Technology*	3.5	3	
		7	1514883002	信号与系统 I*   Signals and Systems I*	3.0	3	
		8	1510923002	数字电子技术*   Digital Electronic Technology*	3.5	4	
		9	1514822002	电磁场与电磁波*   Electromagnetic Field and Electromagnetic Wave*	2.0	4	
		10	1514892002	数字信号处理*   Digital Signal Processing*	2.5	4	
	专业基础 Subject Foundation Requisite	11	1517122002	通信原理 I*   Principles of Communication I*	2.5	5	
		12	1526982002	计算机组成原理*    Principle of Computer Organization*	2.5	5	
		13	1514832002	信息论与编码*   Information Theory and Coding*	2.0	6	
		14	1517062002	计算机网络*   Computer Networks*	2.5	6	
		15	1514902002	高频电子与通信电路*   High Frequency Electronics and Communication Circuits*	2.5	6	
	专业教育课 Specialized Education	信号处理与信息 集成 Signal Processing and Information Integration	16	1514662002	化工过程信息处理与传输   Chemical Process Information Processing and Transmission	2.0	6
			17	1524852002	数字图像处理   Digital Image Processing*	2.5	6

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》

### 十一、全学程实践环节周历安排 Weekly Calendar of all Practice Sessions

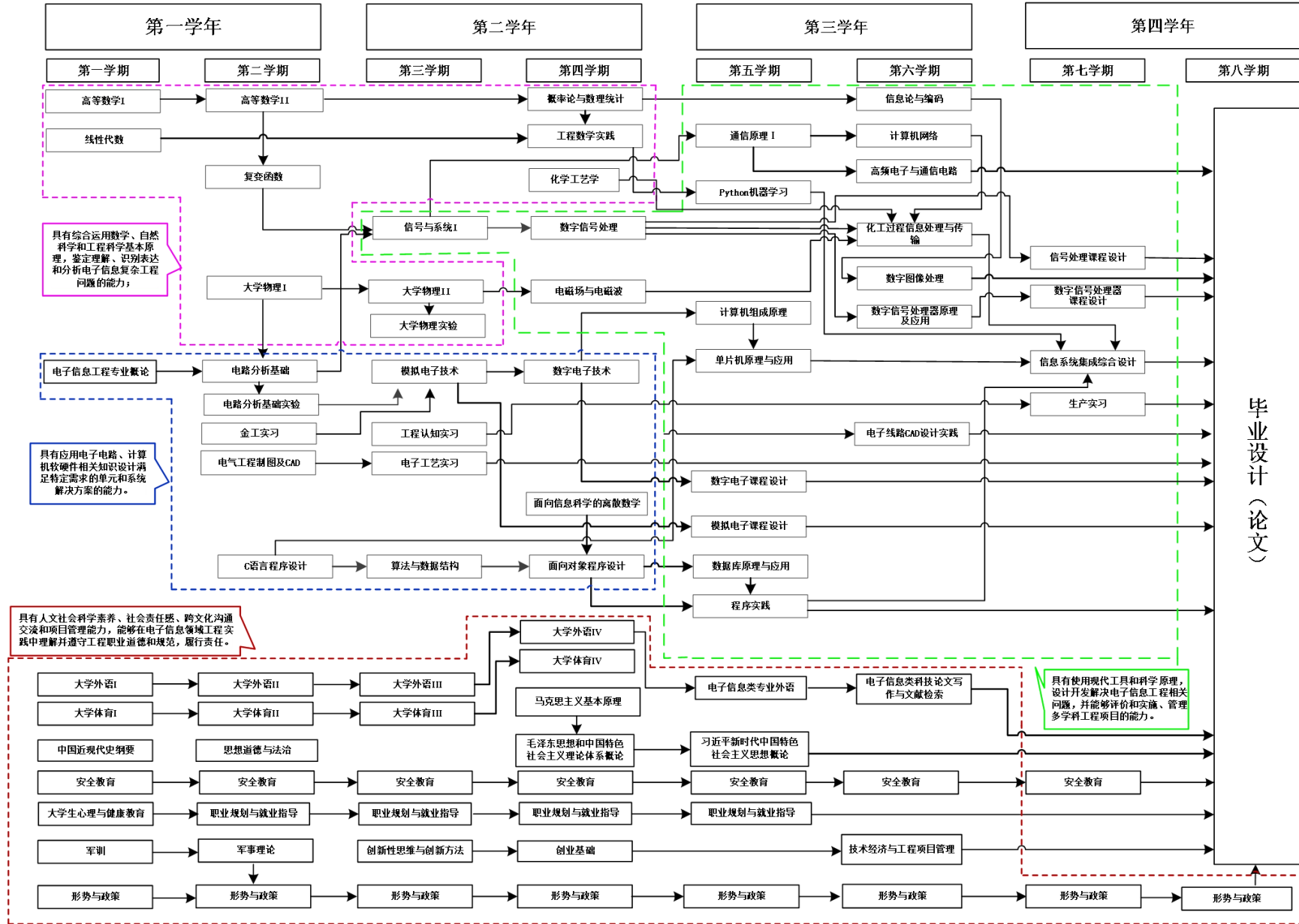
学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注
一		☆	☆															::	::	●		军训
二													※					::	::	●	●	金工实习
三				P	P													::	::	●		电子工艺实习
四															P	P		::	::	●	●	工程数学实践
五																		::	::	●		
六																△		::	::	●	●	电子线路 CAD 设计 实践
七	△	△	△	/	/	△														●		信号处理课程设 计、数字信号处 理器、生产实习、 信息系统集成综 合设计
八	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=					毕业设计 (论文)

831

符号说明(Symbol Description):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P 各类实  
训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼ 认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计 (论文)  
||Graduation Project(Thesis)    ●小学期||Primary Term

## 十二、课程体系配置图 Curriculum System Configuration Diagram



十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements (High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																													
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	6.1	6.2	7.1	7.2	8.1	8.2	9.1	9.2	10.1	10.2	11.1	11.2	12.1	12.2	
马克思主义基本原理   Basic Principles of Marxism																					H									
中国近现代史纲要   Outline of Chinese Contemporary and Modern History																					H									
思想道德与法治    Ideological Morality and the Rule of Law																						H								
毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*																					H									
习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																					M									
形势与政策   Current Situation and Policies											H						M			H									M	
大学体育   College Physical Education																							L							
大学外语   College English																										L				
高等数学   Advanced Mathematics	H																													











课程 (Courses)	毕业能力要求 (Graduation Requirements)																												
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	6.1	6.2	7.1	7.2	8.1	8.2	9.1	9.2	10.1	10.2	11.1	11.2	12.1	12.2
大学生素质拓展与创新实践   Quality Development and Innovation Practice																H													
化工过程信息处理与传输   Chemical Process Information Processing and Transmission				M			M	M				M																	



# 沈阳化工大学本科培养方案

## 信息工程学院

专业名称：电子科学与技术

专业代码：080702

制 定：王 健

审 核：孔晓光

审 定：于三三

批 准：金志浩

2021 年 8 月

# 电子科学与技术专业培养方案

## 一、培养目标

本专业坚持“立德树人，回归教育初心”的育人理念，培养综合素质良好，德、智、体、美、劳全面发展，具备电子科学与技术专业知识，具有较强工程实践能力和创新意识，能够在电子信息及相关领域从事微电子器件的工程设计、制造、应用开发和项目管理等工作的高素质应用型工程技术人才和社会主义接班人。

毕业 5 年后的学生：

(1) 具有扎实的理论基础，具备适应电子信息领域发展的专业能力和专业视野，能够综合运用数学、自然科学、专业知识以及交叉学科知识，对电子信息及相关领域的微电子器件复杂工程问题的解决方案进行分析和设计。

(2) 具有在企业与社会环境下，运用现代工具对电子信息及相关领域的微电子器件进行分析、设计、制造和应用的能力。

(3) 具有高度的社会责任感和道德修养、健全的人格、良好的心理素质和人文科学素养、和谐包容的团队精神、有效的沟通与表达能力和工程项目管理能力，在工程实践中能综合考虑法律、环境与可持续性发展等因素，具有坚持公共利益优先的素质。

(4) 具有广阔的国际视野，主动适应不断变化的国内外形势和环境，能够通过多种学习渠道更新知识，形成终生学习的习惯，实现能力和技术水平的提升。

## 二、专业方向

微电子技术。

## 三、毕业要求

本方案根据本科专业类教学质量国家标准、专业认证标准中的要求，基于成果导向教育理念，依据人才培养目标和专业多年形成的人才培养特色，针对电子科学与技术专业的特点，制定本专业毕业能力要求和指标点分解。

本专业毕业能力要求和指标点分解：

毕业能力要求	指标点
毕业要求 1： 工程知识：掌握数学、自然科学、工程基础和电子科学与技术专业知识用于解决微电子器件设计、制造和应用中的复杂工程问题。	1-1.能够将数学、自然科学、工程基础和专业知识运用到复杂工程问题的恰当表述中。
	1-2.能够将工程基础和专业知识用于微电子系统单元的设计和分析。
	1-3.能够将工程基础和专业知识用于电子信息及相关领域的微电子系统分析和优化。
	1-4.能够将工程基础和专业知识用于对电子信息及相关领域的微电子系统进行设计和改进。
毕业要求 2： 问题分析：能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究来分析微电子器件设计、制造和应用中的复杂工程问题	2-1.能够运用数学、自然科学和工程科学的基本原理，识别电子信息及相关领域的微电子器件设计、制造及应用的复杂工程问题中的关键环节和参数。
	2-2.能够通过模拟分析、基于工艺和系统运行指标分析等方法正确表达电子信息及相关领域的微电子器件设计、制造及应用的复杂工程问题。

题, 以获得有效结论。	2-3.能够通过文献研究来分析电子信息及相关领域的微电子器件设计、制造及应用的复杂工程问题, 以获得有效结论。
毕业要求 3: 设计/开发解决方案: 在综合考虑社会、健康、安全、法律、文化以及环境等因素的前提下, 能够针对微电子器件设计、制造和应用中的复杂工程问题设计解决方案, 设计满足特定需求的系统和单元, 并能够在设计环节中体现创新意识。	3-1.能够在综合考虑社会、健康、安全、环境、法律等现实约束条件下, 对电子信息及相关领域的微电子器件设计、制造及应用系统的复杂工程问题设计解决方案。
	3-2.能够根据用户的特定需求, 设计合理的微电子系统和单元。
	3-3.能够综合考虑社会、健康、安全、环境、法律等现实约束条件下, 通过对微电子器件设计、制造及应用的设计方案进行优化, 体现创新意识。
毕业要求 4: 研究: 能够基于科学原理并采用科学方法对微电子器件设计、制造和应用中的复杂工程问题进行研究, 包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。	4-1.能够基于专业理论, 根据对象特性, 设计可行的研究方案。
	4-2.能够基于科学原理并采用科学方法对微电子器件设计、制造及应用的复杂工程问题设计实验方案, 开展实验, 分析与解释数据。
	4-3.能够针对微电子器件相关的复杂工程问题进行应用研究, 并通过信息综合得到合理有效的结论。
毕业要求 5: 使用现代工具: 掌握文献检索、资料查询以及运用现代信息技术获取相关信息的基本方法, 能够针对微电子器件设计、制造和应用中的复杂工程问题, 开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具, 包括对复杂工程问题的预测与模拟, 并能够理解其局限性。	5-1.掌握文献检索、资料查询以及运用现代信息技术获取相关信息的基本方法。
	5-2.能够正确选择与使用仿真工具、人机界面集成工具等技术、资源, 对微电子器件设计、制造及应用的复杂工程问题进行预测与模拟。
	5-3.在解决微电子器件相关的复杂工程问题实践中提高现代工具的应用能力, 并能够理解其局限性。
毕业要求 6: 工程与社会: 能够基于微电子器件设计、制造和应用中的背景知识进行合理分析, 评价专业工程实践和复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响, 并理解应承担的责任。	6-1.掌握社会、健康、安全、法律以及文化等方面的相关知识, 能够基于电子信息及相关领域背景知识进行合理分析。
	6-2.能够评价工程实践和工程方案对社会、健康、安全、法律以及文化的影响, 理解在电子信息及相关领域的微电子器件及应用系统相关工程实践中应承担的责任。
毕业要求 7: 环境和可持续发展: 能够理解和评价针对微电子器件设计、制造和应用的复杂工程问题的工程实践对环境、社会可持续发展的影响。	7-1.能够理解和体验针对微电子器件设计、制造和应用相关的复杂工程问题的工程实践对环境、社会可持续发展的影响。
	7-2.能够运用环境与可持续发展等相关法律法规分析、评价针对微电子器件设计、制造和应用相关的复杂工程问题的工程实践对环境、社会可持续发展的影响。
毕业要求 8: 职业规范: 具有人文社会科学素养、社会责任感, 能够在微电子器件设计、制造和应用中的工程实践中理解并遵守工程职业道德和规范, 履行责任。	8-1.培养良好的世界观、人生观, 了解国家与社会发展。
	8-2.能够树立和践行社会主义核心价值观, 理解个人与社会的关系, 了解中国国情, 明确个人作为社会主义事业建设者和接班人所肩负的责任和使命。具有良好的人文社会科学素养。
	8-3.理解工程师的职业性质和责任; 遵守工程职业道德和规范, 并履行责任。
毕业要求 9: 个人和团队: 能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。	9-1.能够在多学科背景下的团队中承担个体角色并发挥个体优势。
	9-2.能够在多学科背景下的团队中承担团队成员角色并发挥团队协作精神。
	9-3.能够在多学科背景下的团队中承担团队负责人角色并发挥管理能力。
毕业要求 10: 沟通: 能够就微电子器件设计、制造和应用中的复杂工程问题与业界同行及社会公众进行有效沟通和交流, 包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令, 并具备一定的国际视野, 能够在跨文化背景下进行沟通和交流。	10-1.具备外语交流能力, 具有一定的国际视野, 能够在跨文化背景下进行沟通和交流。
	10-2.了解电子信息领域发展趋势和热点问题, 利用图表、公式、计算、图纸等内容的整合表达思想, 就微电子器件设计、制造和应用相关的复杂工程问题与业界同行及社会公众有效地进行口头和书面的信息交流。
毕业要求 11: 项目管理: 理解并掌握工程管理原	11-1.理解并掌握一定的工程管理原理与经济决策方法。

理与经济决策方法，并能在多学科环境中应用。	11-2. 能够应用工程管理原理与经济决策方法对微电子器件设计、制造和应用相关的复杂工程问题进行有效分析和综合评价。
毕业要求 12: 终身学习：具有自主学习和终身学习的意识，有不断学习和适应发展的能力。	12-1. 充分认识到电子信息领域微电子器件设计、制造和应用系统的快速发展，能在社会发展的大背景下，认识到不断探索和学习的必要性，具有自主学习和终身学习的意识。
	12-2. 具有自主学习能力，掌握终身学习的语言工具和计算机工具，具有健康良好的体魄和心理，以适应工作中的各种任务。

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系阵。

### 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标			
	培养目标 1	培养目标 2	培养目标 3	培养目标 4
1: 工程知识	√			
2: 问题分析	√			
3: 设计/开发解决方案	√			
4: 研究		√		
5: 使用现代工具		√		
6: 工程与社会		√		
7: 环境和可持续发展			√	√
8: 职业规范			√	
9: 个人和团队			√	
10: 沟通			√	√
11: 项目管理			√	
12: 终身学习				√

#### 四、主干学科

电子科学与技术

#### 五、专业核心课程

电路分析基础、模拟电子技术、数字电子技术、信号与系统I、半导体物理学、微电子器件基础、光电子技术、单片机原理与应用、数字系统与逻辑设计、微电子工艺原理、集成电路原理与设计、光伏材料学。

#### 六、修业年限

本科基本学制 4 年，弹性学习年限 3-6 年，按照学分制度管理。

#### 七、授予学位



学生应至少修满 167 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者，可授予工学学士学位。

## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例 (%)
通识教育课	通识教育必修课	思政类	必修	17	41.5	24.9
		外语类		12		
		计算机类		2.5		
		军事安全类		2		
		劳动体育类		5		
		创新创业类		2		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	2	8	4.8
		中国与世界(500)		2		
		四史(600)		1		
		经济管理类(700)		1		
		传统文化(900)		2		
	通识教育实践课	军训	实践	2	2	1.2
学科平台课	学科基础课程	公共基础类	必修	63	73	69.2
		专业基础类				
	学科实践课程	-	实践	10		
专业教育课	专业核心课程	-	必修	12	38	69.2
	专业选修课程	-	选修	4		
	专业实践课程	-	实践	22		
能力拓展课	专业特色课程	-	必修(或实践)	4.5	4.5	
课外环节	课外通识实践	人文社会实践	课外实践	4	4	
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
	生涯教育	成长规划类		1		
总学分/比例					167	100

# Electronic Science and Technology Major 2021 Undergraduate Education Program

## I. Educational Objectives

Adhering to the educational concept of "fostering virtue through education and returning to the original intention of education", this major is committed to the cultivation of high-quality application-oriented engineering and technical talents and socialist successors with good comprehensive quality, who will improve all round in terms of morality, intelligence, physical ability, aesthetic sensibility and work skills, possess professional knowledge of electronic science and technology, strong engineering practice ability and innovation consciousness and engage in engineering design, manufacture, application development and project management of microelectronics devices in electronic information and related fields.

Students 5 years after graduation:

(1) Having a solid theoretical foundation, and the professional ability and vision to adapt to the development in the electronic information field; being able to analyze and design solutions to complex engineering problems of microelectronics devices in electronic information and related fields by combining mathematics, natural science, professional and interdisciplinary knowledge.

(2) Having the ability to analyze, design, manufacture and apply microelectronic devices with modern tools in electronic information and related fields in a corporate and social environment.

(3) Having a high degree of social responsibility and moral cultivation, sound personality, good mentality and humanistic quality, harmonious team spirit, effective communication and expression ability and project management ability; being able to comprehensively consider the factors such as law, environment and sustainable development and stick to the principle of public interest first in engineering practice.

(4) Having broad international vision; taking the initiative to adapt to the constantly changing situations and environments at home and abroad; being able to update knowledge through a variety of learning channels and form a habit of lifelong learning to improve ability and technical level.

## II. Major direction

Microelectronic technology

## III. Graduation Requirements

According to the requirements of the national standards of undergraduate professional teaching quality and professional certification standards, based on the concept of achievement oriented education, according to the talent training objectives and professional training characteristics formed over the years, and in view of the characteristics of the field of electronic science and technology, the graduation ability requirements and index points of this specialty are formulated.

Graduates should obtain knowledge and competences as follows:

Graduation Requirements	Indices
<p>Requirement 1: Engineering knowledge: Mastering mathematics, natural sciences, fundamentals of engineering and electronic science and technology expertise to solve complex engineering problems in the design, manufacture and application of micro-electronic devices.</p>	1-1. Being able to apply the fundamentals and expertise of mathematics, science, and engineering to the appropriate presentation of complex engineering problems.
	1-2. Being able to apply the fundamentals and expertise of engineering to the design and analysis of microelectronic system units.
	1-3. Being able to apply the fundamentals and expertise of engineering to the analysis and optimizing of microelectronic systems in electronic information and related fields.
	1-4. Being able to apply the fundamentals and expertise of engineering to the design and improvement of microelectronic systems in electronic information and related fields.
<p>Requirement 2: Problem Analysis: Being able to apply the basic principles of mathematics, natural science and engineering science to identify, express, and analyze, through literature research, complex engineering problems in the design, manufacture, and application of microelectronic devices to reach effective conclusions.</p>	2-1. Being able to apply the basic principles of mathematics, natural science and engineering science to identify critical aspects and parameters of complex engineering problems in the design, manufacture and application of micro-electronic devices in electronic information and related fields.
	2-2. Being able to express complex engineering problems in the design, manufacture and application of microelectronics devices in electronic information and related fields by means of simulation analysis and analysis based on process and system operation indicators.
	2-3. Being able to analyze complex engineering problems in the design, manufacture and application of microelectronic devices in electronic information and related fields through literature research to obtain effective conclusions.
<p>Requirement 3: Design/development of solutions: under the premise of comprehensive consideration of social, health, safety, legal, cultural and environmental factors, being able to design solutions to complex engineering problems in the design, manufacture and application of microelectronic devices so as to meet specific needs for systems and units and demonstrate the sense of innovation in the design session.</p>	3-1. Being able to design solutions to complex engineering problems in the design, manufacture and application of microelectronic devices in electronic information and related fields, taking into account social, health, safety, environmental and legal constraints.
	3-2. Being able to design reasonable microelectronic systems and units according to the specific needs of users.
	3-3. Being able to optimize the design, manufacture and application of micro-electronic devices under the realistic constraints of society, health, safety, environment and law, and demonstrate the sense of innovation.
<p>Requirement 4: Research conduction: being able to use scientific principles and methods to conduct research on complex engineering problems in the design, manufacture and application of microelectronic devices, including designing experiments, analyzing and interpreting data, and obtaining reasonable and effective conclusions through information synthesis.</p>	4-1. Being able to design feasible research schemes based on professional theories and object characteristics.
	4-2. Being able to design plans, conduct experiments, analyze and interpret data based on scientific principles and methods for complex engineering problems in the design, manufacture and application of micro-electronic devices.
	4-3. Being able to do application research on complex engineering problems related to microelectronic devices and obtain reasonable and effective conclusions through information synthesis.

<p><b>Requirement 5:</b> Use of modern tools: mastering the basic methods of literature retrieval, data inquiry and relevant information acquisition by using modern information technology; being able to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for complex engineering problems in the design, manufacture and application of microelectronic devices, including prediction and simulation of complex engineering problems and understanding of their limitations.</p>	5-1. Mastering the basic methods of literature retrieval, data inquiry and obtaining relevant information acquisition by using modern information technology.
	5-2. Being able to correctly select and use simulation tools, human-computer interface integration tools and other technologies and resources to predict and simulate complex engineering problems in the design, manufacturing and application of microelectronics devices.
	5-3. Developing the ability to apply modern tools and understanding their limitations in the practice of solving complex engineering problems related to microelectronic devices.
<p><b>Requirement 6:</b> Engineering and Society: Being able to analyze and evaluate the impact of professional engineering practices and solutions to complex engineering problems on society, health, safety, laws, as well as culture and understand the responsibilities, based on background knowledge in the design, manufacture, and application of microelectronic devices.</p>	6-1. Mastering knowledge of society, health, safety, laws and culture, and being able to make rational analyses based on background knowledge of electronic information and relevant fields .
	6-2. Being able to evaluate the impact of engineering practices and solutions on society, health, safety, laws as well as culture and understand the responsibilities of engineering practices related to microelectronics devices and application systems in electronic information and related fields.
<p><b>Requirement 7:</b> Environment and Sustainability: Being able to understand and evaluate the impact of complex engineering practices in the design, manufacture and application of microelectronic devices on environmental and social sustainability.</p>	7-1. Being able to understand and experience the impact of complex engineering practices related to the design, manufacture and application of microelectronic devices on environmental and social sustainability.
	7-2. Being able to apply the laws and regulations of environment and sustainable development to analyze and evaluate the impact of complex engineering practices related to the design, manufacture and application of micro-electronic devices on environmental and social sustainable development.
<p><b>Requirement 8:</b> Professional norms: With good literacy of humanities and social science as well as social responsibility, being able to understand and abide by engineering professional ethics and norms and fulfill responsibilities in the design, manufacture and application of microelectronic devices.</p>	8-1. Being trained to have a good outlook on the world and life, and understand the development of the country and society
	8-2. Being able to establish and practice socialist core values, understand the relationship between individuals and society; being clear about China's national conditions and the responsibilities and missions of individuals as builders and successors of the socialist cause. Having a good humanities and social science literacy.
	8-3. Understanding the professional nature and responsibilities of engineers; abiding by engineering professional ethics and codes and fulfilling responsibilities.
<p><b>Requirement 9:</b> Individuals and Teams: Being able to act as individuals, team members, and leaders in a multidisciplinary team.</p>	9-1. Being able to take on individual roles and leverage their strengths in a multi-disciplinary team.
	9-2. Being able to play the role of team member and team spirit in a multi-disciplinary environment.

	9-3. Being able to take on the role of team leader and develop management skills in a multi-disciplinary team.
Requirement 10: Communication: Being able to effectively communicate with other professionals of the trade and the public on complex engineering issues in the design, manufacture and application of microelectronic devices, including writing reports, designing drafts, giving presentations, and clearly issuing or responding to directives, and having international vision and being capable of cross-cultural communication..	10-1. Having the ability to communicate in a foreign language, possessing a certain international vision, and being able to communicate and communicate in a cross-cultural context.
	10-2. Understanding the development trend and hot issues in the field of electronic information, using the integration of charts, formulas, calculations, drawings and other contents to express ideas, and effectively communicate oral and written information with industry peers and the public on complex engineering issues related to the design, manufacture and application of micro -electronic devices.
Requirement 11: Project Management: Understanding and mastering the principles of engineering management and economic decision-making methods, and being able to apply them in a multidisciplinary environment.	11-1. Understanding and mastering certain engineering management principles and economic decision-making methods.
	11-2. Being able to apply engineering management principles and economic decision-making methods to effectively analyze and comprehensively evaluate complex engineering problems related to the design, manufacture and application of micro-electronic devices.
Requirement 12: Lifelong learning: Having the consciousness of autonomic learning and lifelong learning, and having the ability to adapt to development through continuous learning.	12-1. Fully understanding the rapid development of microelectronics device design, manufacturing and application system in the field of electronic information, realizing the necessity of continuous exploration and learning under the background of social development, and having the consciousness of autonomous learning and lifelong learning.
	12-2. Having the ability of self-learning, mastering the lifelong learning language tools and computer tools, having good physical and mental health to adapt to various tasks in the work.

### The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives			
	Educational Objective 1	Educational Objective 2	Educational Objective 3	Educational Objectives 4
1: Engineering Knowledge	√			
2: Problem Analysis	√			
3: Design/Development of Solutions	√			
4: Research conduction		√		
5: Use Modern Tools		√		
6: Engineering and Society		√		
7: Environment and Sustainable Development			√	√
8: Career Planning			√	
9: Individuals and Teams			√	
10: Communicate			√	√

11: Project Management			√	
12: Lifelong Learning				√

#### **IV. Major Subject**

Electronic Science and Technology

#### **V. Core Courses**

Fundamentals of Circuit Analysis, Analog Electronic Technology, Digital Electronic Technology, Signals and Systems I, Fundamentals of Microelectronic Devices, Optoelectronic Technology, The Application and Principal of MCU, Principles of Microelectronic Technology, Digital System and Logic Design, Principles of Integrated Circuit Design, photovoltaic materials.

#### **VI. Educational System**

The basic length of undergraduate education is 4 years, and the flexible study period is 3-6 years, which is managed according to the credit system.

#### **VII. Confer Degrees**

Students should have at least 167 credits to graduate. Those who meet the requirements of the Degree Awarding Regulations for Undergraduates of Shenyang University of Chemical Technology (Revised in March 2017) will be awarded the Bachelor of Engineering degree.

## VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit requirement	Subtotal	Proportion (%)
General Education	General Education (Compulsory)	Ideological and Political Courses	Compulsory	17	41.5	24.9
		Foreign Language Courses		12		
		Computer Courses		2.5		
		Military and Safety Courses		2		
		Labor and Sport Education		5		
		Innovation and Entrepreneurship		2		
		Mental Health		1		
	General Education (Optional)	Aesthetic Education(400)	Optional	2	8	4.8
		China and the World(500)		2		
		Four Histories(600)		1		
		Economic Management(700)		1		
Traditional Culture(900)		2				
General Education (Practice)	Military Training	Practice	2	2	1.2	
Discipline Education	Basic Courses	Public Basic Class	Compulsory	63	73	69.2
		Professional Foundation				
	Basic Practice Sessions	-	Practice	10		
Specialized Education	Core Courses	-	Compulsory	12	38	
	Optional Courses	-	Optional	4		
	Specialized Practice Sessions	-	Practice	22		
Competency Development	Individualized Courses	-	Compulsory (or Practice)	4.5	4.5	
Extracurricular Links	Extracurricular General Education Practice	Culture and Society Practice	Extracurricular Practice	4		
		Mentally and Physically Practice				
		Foreign Language Proficiency Training Practice				
	Extracurricular Characteristic Practice	Innovative Training		4		
		Innovation Competition				
		Chuangke Activities				
Career Education	Growth Planning Courses	1				
Total/Proportion					167.0	100



### 九、电子科学与技术专业教学进程表

#### Table of Teaching Schedule for Electronic Science and Technology Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C. H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
通识教育课 General Education	必修 Compulsory	思政类 Ideological and Political Courses	0710093001	思想道德与法治    Ideological Morality and the Rule of Law	3.0	48	32			16		2								
			0710053001	中国近现代史纲要    Outline of Chinese Contemporary and Modern History	3.0	48	32			16	2									
			0710123001	习近平新时代中国特色社会主义思想概论    Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8					3					
			0710103001	马克思主义基本原理*    Basic Principles of Marxism*	3.0	48	32			16				2						
			0710133001	毛泽东思想和中国特色社会主义理论体系概论*    Mao Zedong Thought and Theory of Socialism with Chinese Characteristics *	3.0	48	32			16				2						
			0710012301	形势与政策    Current Situation and Policies	2.0	64	64				2	2	2	2	2	2	2	2		
				0211003101	大学外语I    College English I	3.0	48	48				3								
				0211003201	大学外语II*    College English II*	3.0	48	48					3							
				0241003301	大学外语III    College English III	3.0	48	48						3					五选一	

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C. H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes			
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th				
通识教育课 General Education	必修 Compulsory	外语类 Foreign Language Courses	0241003301	大学外语III（进阶英语）    College English III（Advanced English CET 6-Orientated）	3.0	48	48						3									
				大学外语III（英语口语表达与交流）    College English III（English Oral Expression and Communication）	3.0	48	48							3								
				大学外语III（跨文化交际）    College English III（Intercultural Communication）	3.0	48	48							3								
				大学外语III（英语写作表达与交流）    College English III(English Writing Expression and Communication）	3.0	48	48							3								
			0241003401	大学外语IV*   College English IV*	3.0	48	48								3							
				大学外语IV（进阶英语）    College EnglishIV（Advanced English CET 6-Orientated）	3.0	48	48								3							
				大学外语IV（英语口语表达与交流）    College EnglishIV（English Oral Expression and Communication）	3.0	48	48								3							
				大学外语IV（跨文化交际）    College English IV（Intercultural Communication）	3.0	48	48								3							
				大学外语IV（英语写作表达与交流）    College English IV（English Writing Expression and Communication）	3.0	48	48								3							
		计算机类 Computer Courses	1511372002	C 语言程序设计   C Language Programming	2.5	44	32			12		2										

五选一

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C. H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
通识教育课 General Education	军事安全类 Military and Safety Courses	0710081001	军事理论   Military Theory	1.0	16	16						2								
		1510261302	安全教育   Safety Education	1.0	16	16					1	1	1	1	1	1	1			
	劳动体育类 Labor and Sport Education	2640021001	劳动教育    Laboure Education	1.0	16	16						2								
		0410011101	大学体育I   College Physical Education I	1.0	36		36			2										
		0410021201	大学体育II   College Physical Education II	1.0	36		36				2									
		0410031301	大学体育III   College Physical Education III	1.0	36		36					2								
		0410041401	大学体育 IV   College Physical EducationIV	1.0	36		36						2							
		创新创业类 Innovation and Entrepreneurship courses	1557011002	创造性思维与创新方法   Creative Thinking and Innovative Methods	1.0	16	16							2						
	1740011001		创业基础   Entrepreneurial Foundation	1.0	16	16							2							
	心理健康类 Mental Health Courses	0510041001	大学生心理与健康教育   Mental and Health Education for College Students	1.0	16	16					2									
	小计 Subtotal				41.5	780	552	144	12	72	12	16	10	14	6	3	3	2		

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C. H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes
						讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八	
										1st	2nd	3rd	4th	5th	6th	7th	8th	
通识教育课 General Education	选修 Optional	包括 5 个模块，分别是经济管理类（1.0）、美育类（2.0）、四史（1.0）、传统文化（2.0）、中国与世界（2.0），每学期最多选修 2 门课程。 It includes five modules, namely, economic management (1 credit), aesthetic education (2 credits), four history (1 credit), traditional culture (2 credits), China and the world (2 credits), and a maximum of 2 courses per semester.																
		小计 Subtotal			8													
	实践 Practice	0415102011	军训   military training	2.0	48				48	+2							集中	
	合计 Total			51.5														
学科平台课 Discipline Education	必修 Compulsory	数学与自然科学类 Natural Science & Mathematics	0310004101	高等数学 I*   Advanced Mathematics I*	4.5	80	72			8	6							
			0310005201	高等数学 II*   Advanced Mathematics II*	5.5	96	88			8	6							
			0310032001	线性代数    Linear Algebra	2.0	32	32				3							
			0310042001	概率论与数理统计   Probability and Statistics	2.0	32	32						2					
			1519501002	面向信息科学的离散数学   Discrete Mathematics in Information Science	1.0	16	16						2					
			1510251002	复变函数   Function of Complex Variable	1.5	24	24					2						
			0310063101	大学物理 I*   University Physics I*	3.0	48	46	2				3						
			0310063201	大学物理 II*   University Physics II*	3.0	48	46	2					3					

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C. H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
学科平台课 Discipline Education	必修 Compulsory		0310122002	固体物理学   Solid State Physics	2	32	32						2							
		工程基础类 Foundation Engineering	1510163002	电路分析基础*   Fundamentals of Circuit analysis	3.5	56	56					4								
			1510141002	电气工程制图及 CAD   Electrical Engineering Drawing and CAD	1.5	26	20		6			2								
			1510913002	模拟电子技术*   Analog Electronic Technology*	3.5	60	48	12					3							
			1510923002	数字电子技术*   Digital Electronic Technology*	3.5	60	48	12						3						
			1514883002	信号与系统I   Signals and Systems I*	3.0	50	44	6						4						
			1514822002	电磁场与电磁波*   Electromagnetic Field and Electromagnetic Wave*	2.0	32	32							2						
		专业基础类 Subject Foundation Requisite	1515221002	电子科学与技术专业概论 Introduction to Electronic Science and Technology	1.0	16	16					2								
			1515623002	半导体物理学*   Physics of Semiconductors	3.0	50	44	6						3						
			1515633002	微电子器件基础*   Fundamentals of Microelectronic Devices*	3.0	52	40	12							3					
			1513822002	单片机原理与应用   The Application and Principal of MCU	2.5	44	32	12								3				
			1513272002	算法与数据结构   Algorithm and Data Structure	2.5	44	32		12					3						
			1515652002	光电子技术*   Optoelectronic Technology*	2.0	36	24	12									2			



课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C. H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
						讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八		
										1st	2nd	3rd	4th	5th	6th	7th	8th		
学科平台课 Discipline Education	实践 Practice	1516311022	电子线路自动化技术设计实践    Electronic Circuit Automation Technology Practice	1.5	36		36								+1.5			集中	
		小计 Subtotal			10	240		240				1.5	3	2	2	1.5			
	合计 Total				73	1302	928	316	42	16	11	18.5	20	12	10	11.5			
专业教育课 Specialized Education	必修 Compulsory	1525662002	微电子工艺原理*   Principles of Microelectronic Technology*	2	36	24		12						2					
		1525673002	集成电路原理与设计*   Principles of Integrated Circuit Design*	3.5	60	48		12								4			
		1525682002	集成电路测试技术    Test Technology of Integrated Circuits	2.0	36	24	12									2			
		1526952002	数字系统与逻辑设计    Digital System and Logic Design	2.0	36	24	12								2				
		1526982002	计算机组成原理*    Principles of Computer Organization*	2.5	42	36	6								3				
		小计 Subtotal			12	210	156	30	24						7	6			
	选修 Optional	1537242002	Matlab 程序设计   Matlab programming	2.0	36	24		12				2							
		1534842002	Python 数据分析与应用   Python data analysis and application	2.0	36	24		12					2						
		1531552002	自动控制原理II   The Principle of Automatic Control II	2.0	34	28	6						2						
		1534872002	语音信号处理   Speech Signal Processing	2.0	36	24		12						2					
		1538563002	ZigBee 技术应用及无线传感器网络   ZigBee Technology and Wireless Sensor Networks	3.0	52	40	12								3				





课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C. H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes			
						讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八				
										1st	2nd	3rd	4th	5th	6th	7th	8th				
专业教育课 Specialized Education	实践 Practice	1515731042	毕业设计（论文）   Graduation Design (Thesis)	14.0	336		336											+14	集中		
		小计 Subtotal			22	528		528				1		1			6	14			
		合计 Total			38							1		8		6	6	14			
能力拓展课 Competency Development	必修或实践 Compulsory or Practice	1525782002	光伏材料学   Photovoltaic materials	2.0	36	24	12									2					
		1526092002	嵌入式系统    Embedded System	2.5	46	28	18										2				
		小计 Subtotal			4.5	82	52	30									4				
		(修读要求 Fill in the Study Requirements) 5.0																			
总计 Sum				167						23	34.5	31	26	24	24.5	9	16				
课外环节 Extracurricular links	课外实践 Extracurricular practice	人文社会实践 Culture and Society Practice	1513401032	社会调查   Social Survey	0.5	12				12								0.5	分散		
		身心健康社会实践 Mentally and Physically Practice	0410050751	课外体育锻炼   Extracurricular Physical Exercise	0.5	12				12								0.5		分散	
			2640030011	劳动教育实践   Laboure Education Practice	0.5	12				12		0.5									分散
			0510070311	心理健康辅导   Mental Health Counseling	0.5	12				12								0.5			分散
		外语技能实践类 Foreign Language Proficiency Training Practice	0210010011	外语技能实践（初级）   Foreign Language Proficiency Training Practice (elementary)	2.0	48				48				2							二选一
			0210020011	外语技能实践（高级）   Foreign Language Proficiency Training Practice (advanced)	2.0	48				48				2							

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C. H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八	
											1st	2nd	3rd	4th	5th	6th	7th	8th	
课外环节 Extracurricular links	课外实践 Extracurricular practice	能力与创新实践 Capability and Innovation Practice	1513414022	大学生素质拓展与创新实践   Quality Development and Innovation Practice	4.0	96				96	1~8 学期依据《沈阳化工大学创新创业实践学分认定办法》由创新创业学院认定								分散
		成长规划类 Growth Planning Courses	1510271312	职业规划与就业指导   Career Planning and Employment Guidance	1.0	40	40				1						1		
小计 Subtotal																			

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5,课程名称中画\*为考试课。

Note: “Cre. (Credits)”, “T.C.H. (Total Credit Hours)”, “Lec. (Lecture)”, “Exp. (Experiment)”, “Pro. (Programming)”, “Pra. (Practice)”.

## 十、电子科学与技术专业学士学位课程一览表

**A list of bachelor's degree programs in Electronic Science and Technology**

课程类别 Course Type	模块名称 Modules	序号 No	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester	
通识教育课 General Education	政治理论 Political Theory	1	0710103001	马克思主义基本原理* Basic Principles of Marxism*	3	4	
		2	0710133001	毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3	4	
学科平台课 Discipline Education	数学 Mathematics	3	0310004101	高等数学 I* Advanced Mathematics I*	4.5	1	
	物理 Physics	4	0310063101	大学物理 I* University Physics I*	3	2	
	工程基础类 Foundation Engineering	5	1510163002	电路分析基础* Fundamentals of Circuit analysis*	3.5	2	
		6	1510913002	模拟电子技术* Analog Electronic Technology*	3.5	3	
		7	1510923002	数字电子技术* Digital Electronic Technology*	3.5	4	
		8	1514883002	信号与系统I* Signals and Systems I*	3.0	3	
	专业基础类 Subject Foundation Requisite	9	1515623002	半导体物理学* Physics of Semiconductors*	3	4	
		10	1515633002	微电子器件基础* Fundamentals of Microelectronic Devices*	3	5	
		11	1513822002	单片机原理与应用 The Application and Principal of MCU	2.5	5	
		12	1515652002	光电子技术* Optoelectronic Technology*	2	6	
	专业教育课 Specialized Education	微电子技术类 Microelectronic technology	13	1525662002	微电子工艺原理* Principles of Microelectronic Technology*	2	5
			14	1526952002	数字系统与逻辑设计 Digital System and Logic Design	2	5
15			1525673002	集成电路原理与设计* Principles of Integrated Circuit Design*	3.5	6	

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》

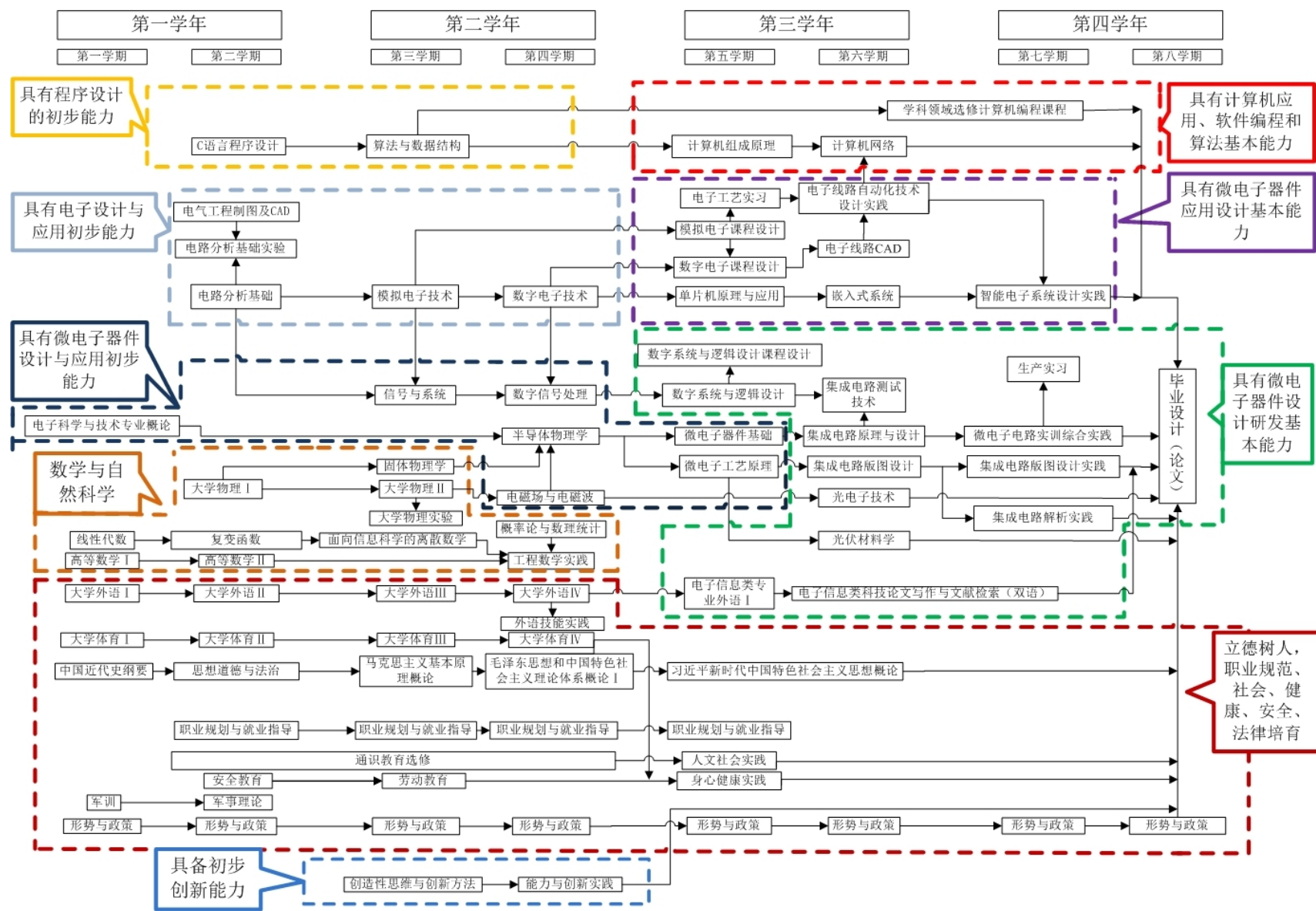
### 十一、全学程实践环节周历安排 Weekly Calendar of all Practice Sessions

学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注
一		☆	☆															::	::	·		
二			※															::	::	·		
三				P	P	▼												::	::	·		
四															P	P		::	::	·		
五								△		△								::	::	·		
六												△						::	::	·		
七	△	△	△	/	/	△												::	::	·		
八	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=					

符号说明(Symbol Description):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P 各类实训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼ 认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计(论文)||Graduation Project(Thesis)    ·小学期||Primary Term

## 十二、课程体系配置图 Curriculum System Configuration Diagram



十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements ( High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																	
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	11.1	11.2	12.1	12.2		
思想道德与法治    Ideological Morality and the Rule of Law																					M	M	H											
中国近现代史纲要   Outline of Chinese Contemporary and Modern History																					M													
习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																					M													
马克思主义基本原理*   Basic Principles of Marxism*																					M													
毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*																				M	H	M												
形势与政策   Current Situation and Policies																					H							M	M					
大学外语   College English																												M	M					M
C 语言程序设计   C Language Programming																M																		M
军事理论   Military Theory																					M													











课程 (Courses)	毕业能力要求 (Graduation Requirements)																																
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	11.1	11.2	12.1	12.2	
嵌入式系统    Embedded System		M													M																		
光伏材料学    Photovoltaic materials															M			M															
社会调查    Social Survey														M										M									
课外体育锻炼    Extracurricular Physical Exercise																			L			L										M	
劳动教育实践    Laboure Education Practice																								M									M
心理健康辅导    Mental Health Counseling																	M						M										
外语技能实践    Foreign Language Proficiency Training Practice																												M					
大学生素质拓展与创新实践    Quality Development and Innovation Practice													H					M									M						M
职业规划与就业指导    Career Planning and Employment Guidance																							M	H									
经济与管理类等选修课    Economic Management, Aesthetic Education , Science and Technology, Four Histories, Traditional Chinese Culture, China and The world																															L		



# 沈阳化工大学本科培养方案

## 信息工程学院

专业名称：人工智能

专业代码：080717T

制 定：李 凌

审 核：孔晓光

审 定：于三三

批 准：金志浩

2021 年 8 月

# 人工智能专业培养方案

## 一、培养目标

本专业面向智能制造、低碳经济与绿色发展服务等新兴行业、对人工智能技术人才的日益增长需求，培养德智体美劳全面发展的社会主义事业的建设者和接班人。在德育方面，培养学生具有坚定的理想信念、健壮的人格品行、良好的人文素养、严谨的伦理规范和强烈的担当包容。在智育方面，培养学生理解相关的人工智能背景；夯实人工智能理论、方法与技术；建立试验设计、探索发现、分析综合、创新创业、协作沟通、学习适应、工程管理等系统思维的意识；熟练应用算法编程、感知建模、认知推理、碳源核算等技术手段，设计和实施人工智能系统技术应用工程。在体育方面，培养学生掌握体育健康知识和体育锻炼技艺，养成运动爱好和终身坚持的习惯。在美育方面，培养学生养成发现美、欣赏美、创造美的情操情怀，积极向上发挥正能量。在劳育方面，培养学生树立劳动光荣的观念，尊重劳动、热爱劳动、热爱公益、勤于实践。学生通过系统学习、工程实践和社会参与，成长为胜任人工智能产品或系统的工程设计、技术开发和服务、运管维护、最优决策支持等工作的新工科人才。

本专业毕业生具有如下目标预测：

(1) 知识：具有扎实的理论基础，具备新工科专业所需的技术知识和推理能力，包括数理和人文的基本基础知识、感知-认知-推理-学习等核心基础知识、人工智能-算法-深度学习-Python 程序设计等高阶基础知识；

(2) 技能：具备扎实的个人技术技能，包括数字图像建模、语音解析建模、自然语言处理建模、文本分析建模等问题表达和设计求解能力，实验观测和数据处理能力，解决复杂 AI 应用工程的系统思维能力；

(3) 素质：具有良好的职业操守，包括勇于创新实践、启发创业意识、追求终身学习、自觉自律自信、坚守工程伦理、展现大局视野等养成性品质；

(4) 职业成就（包含职业发展和职业竞争力等）：在未来 AI 时代工作及生活的社会环境中，具有承担工程界和工程师为社会创造物质财富的责任意识；在智能制造企业及 AI 工业服务商业环境中，具有凝炼企业文化、提出发展规划、开展技术创新、组织团队攻关的行为表现；初步具备构思-设计-实施-运行（CDIO）AI 制造和服务等相关系统的经历和思维意识。

## 二、专业方向

人工智能

## 三、毕业要求

根据本专业人才培养目标，从适应社会发展的需求出发，明确现阶段本专业的毕业能力要求及其指标点分解：

毕业能力要求	指标点
毕业要求 1： 工程知识：具备较扎实的数学、自然科学知识，系统掌握人工智能领域的工程基础和专业知识，	1-1. 学生应理解与掌握数学、物理等自然科学的基础知识，并具有一定的现代科学与技术方法论意识。
	1-2. 学生应理解与掌握人工智能的基础理论和基本方法，理解人工智能系统中的基本工程知识，并具有一定的计算思维能力

能够将各类知识用于解决人工智能领域复杂工程问题。	1-3.学生应能够在课程考核、实践环节以及毕业设计（论文）等中，应用数学与自然科学、工程基础和专业知识解决人工智能系统及应用中的复杂工程问题
毕业要求 2： 问题分析：能够应用数学、自然科学和工程科学的基本原理，进行抽象分析与识别、建模表达、并通过文献研究分析人工智能领域复杂工程问题，以获得有效结论。	2-1.学生应能够通过应用数学、自然科学、人工智能的基本理论与方法，分析与识别相关实际工程应用问题的复杂性，并进行清晰的描述与表示。 2-2.学生应具有运用多种文献检索方式查找所需参考文献的能力，同时具有相关文献综述与分析的能力 2-3.学生应能够在课程考核、实践环节以及毕业设计（论文）等中，应用数学、自然科学、人工智能的方法对相关复杂工程问题进行分析、表述、推理与验证等。
毕业要求 3： 设计/开发解决方案：能够设计针对人工智能领域复杂工程问题的解决方案，设计满足特定需求的软硬件系统、模块或算法流程，并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素。	3-1.学生应掌握人工智能技术应用问题的基本设计原理与方法，能够针对相关复杂工程问题设计合理的解决方案。 3-2.学生应能够从设计方法学上理解与掌握人工智能技术及其应用的相关复杂工程问题的解决方法，并在解决过程中体现出一定的创新思维能力。 3-3.学生应能够在课程考核、实践环节以及毕业设计（论文）等中，树立综合考虑社会与文化、健康与安全、伦理与法律、环境与发展等诸多因素的意识。
毕业要求 4： 研究：能够基于人工智能领域科学原理并采用科学方法对复杂的人工智能软硬件及系统工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。	4-1.学生应理解与掌握人工智能的基本理论与方法，并从科学技术方法论上理解本专业的基本研究方法。 4-2.学生应能够针对复杂计算机科学与人工智能工程问题运用相关的理论和方法建立定性或定量模型，进行分析与比较；能够掌握原始数据收集与处理方法、参数分析方法、实验结果检验方法与综合分析方法。 4-3.学生应能够在课程考核、实践环节以及毕业设计（论文）等中，通过一定数量的设计实验、仿真实验、研究性专题或项目等，研究与开发复杂工程问题的解决方案。
毕业要求 5： 使用现代工具：能够针对人工智能领域复杂工程问题，开发、选择与使用恰当的技术、软硬件及系统资源、现代工程研发工具和检索工具，包括对复杂工程问题的预测与模拟，并能够理解其局限性。	5-1.学生应能够熟练运用程序设计方法、环境与工具，包括软件开发集成环境，实验数据分析工具，模拟与仿真工具等。 5-2.学生应能够熟练掌握人工智能系统的应用环境与开发工具等，包括 Python 与机器学习环境、人工智能计算平台、深度学习平台等。 5-3.学生应能够选择与运用人工智能的方法、平台与工具，针对复杂工程问题的解决方案，进行分析与比较、预测与模拟，并能够理解与表述问题解决方案的局限性。
毕业要求 6： 工程与社会：能够基于人工智能工程领域相关背景知识进行合理分析，评价人工智能专业工程实践和复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的社会责任。	6-1.学生应理解社会、安全、健康、伦理、法律等方面的基本知识，并理解其与人工智能应用系统的相互影响，特别是人工智能伦理。 6-2.在解决复杂工程问题的过程中，学生应能够从人文与社会、健康与安全、伦理与法律等方面进行分析、比较与评价，能够体现应尽义务、操守与责任。
毕业要求 7： 环境和可持续发展：能够理解和评价针对人工智能领域复杂工程问题的工程实践对环境、社会可持续发展的影响。	7-1.学生应具有环境与可持续发展的基本知识与意识，能够理解人工智能及其应用对当前社会环境与自然环境，以及可持续发展的影响与重要性。 7-2.学生能够理解复杂工程问题的任何工程实践都有可能对环境与可持续发展产生影响，针对具体问题的解决方案能够进行环境与可持续发展影响方面的分析与评价。

<b>毕业要求 8:</b> 职业规范: 具有人文社会科学素养、社会责任感, 能够在工程实践中理解并遵守工程职业道德和规范, 履行责任。	8-1. 人文素养: 具有科学的世界观、人生观和价值观, 能正确理解个人在社会、历史以及自然环境中的地位, 具有推动民族复兴和社会进步的责任感。
	8-2. 职业规范: 了解工程科技人员的职业性质和责任, 能在人工智能工程实践中理解并恪守工程职业道德和规范, 履行相应责任。
<b>毕业要求 9:</b> 个人和团队: 能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。	9-1. 学生应理解尊重个人权利与利益的重要性, 理解个人、团队、社会的关系, 理解个人和团队的利益统一性, 以及团队不同成员及负责人的作用。
	9-2. 学生应参加一定的跨院系、跨专业的社团组织或竞赛等科技活动, 或参加一定的工程实习、社会实践、公益活动、调研等, 并能够在其中发挥应有的作用。
<b>毕业要求 10:</b> 沟通: 能够就人工智能相关的复杂工程问题与业界同行及社会公众进行有效沟通和交流, 包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令, 并具备一定的国际视野, 能够在跨文化背景下进行沟通和交流。	10-1. 学生应具有人工智能专业方面的外语文献阅读与文献检索能力, 具有专业外语交流与写作能力, 具有国际视野, 能够在跨文化背景下进行沟通和交流。
	10-2. 学生应能够在各种教学和实践环节中, 针对复杂工程问题解决方案与同学、同行及公众进行有效沟通和交流, 包括撰写报告和设计文稿、陈述发言、清晰表达观点, 准确回应提问等。
<b>毕业要求 11:</b> 项目管理: 理解并掌握工程管理原理与经济决策方法, 能在多学科环境中应用。	11-1. 学生应理解与掌握一般工程项目规划与管理、工程决策与经济的基本知识与方法, 并对当前人工智能的相关产业有一定的认识。
	11-2. 学生应能够在课程考核、实践环节、科技活动, 以及毕业设计(论文)等中, 理解并运用工程管理原理和经济决策方法等多学科知识解决相关复杂工程问题。
<b>毕业要求 12:</b> 终身学习: 具有自主学习和终身学习的意识, 有不断学习和适应人工智能相关技术发展的能力。	12-1. 学生应能够理解自主学习和终身学习的重要性与必要性, 掌握一定的自主学习和终身学习的方法。
	12-2. 学生应能够在本专业的各种教学和实践环节中, 体现出自主学习和终身学习意识, 在复杂工程问题的解决方案中体现出一定的自主学习和终身学习的能力。

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。

### 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标			
	培养目标 1	培养目标 2	培养目标 3	培养目标 4
1: 工程知识	√			
2: 问题分析	√	√		
3: 设计/开发解决方案	√	√		
4: 研究		√		√
5: 使用现代工具		√		√
6: 工程与社会		√	√	√
7: 环境和可持续发展			√	√
8: 职业规范			√	√
9: 个人和团队			√	√
10: 沟通			√	√
11: 项目管理			√	√
12: 终身学习			√	√



#### 四、主干学科

电子信息类

#### 五、专业核心课程

电路分析基础、数字电子技术、模拟电子技术、自动控制原理、认知心理学、神经生物学概论、人工智能基础、机器学习、自然语言处理、计算机视觉与模式识别、数字图像处理、神经网络与深度学习、智能系统设计等。

#### 六、修业年限

本科基本学制 4 年，弹性学习年限 3-6 年，按照学分制度管理。

#### 七、授予学位

学生应至少修满 169 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者，可授予工学学士学位。

## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例 (%)
通识教育课	通识教育必修课	思政类	必修	17.0	41.5	24.6
		外语类		12.0		
		计算机类		2.5		
		军事安全类		2.0		
		劳动体育类		5.0		
		创新创业类		2.0		
		心理健康类		1.0		
	通识教育选修课	美育类(400)	选修	2.0	8.0	4.7
		中国与世界(500)		2.0		
		四史(600)		1.0		
		经济管理类(700)		1.0		
		传统文化(900)		2.0		
	通识教育实践课	军训	实践	2.0	2.0	1.18
学科平台课	学科基础课程	公共基础类	必修	58.5	66.0	69.52
		专业基础类				
	学科实践课程	-	实践	7.5		
专业教育课	专业核心课程	-	必修	14.5	43.5	
	专业选修课程	-	选修	4.0		
	专业实践课程	-	实践	25.0		
能力拓展课	专业特色课程	-	必修 (或实践)	8.0	8.0	
课外实践环节	课外通识实践	人文社会实践	课外实践	4.0		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4.0		
		创新大赛				
		创客活动				
	生涯教育	成长规划类		1.0		
总学分/比例					169	100

# Undergraduate Education Program for Artificial Intelligence Major 2021

## I. Educational Objectives

This major is oriented to the growing demand for artificial intelligence technical talents in emerging industries such as intelligent manufacturing, low carbon economy and greentech services, and aims to train builders and successors of the socialist cause with all-round development in moral, intellectual, physical, aesthetic and labor. In terms of moral education, students are trained to have firm ideals and beliefs, strong personality, good humanistic quality, rigorous ethical norms and strong tolerance. In terms of intellectual education, students are trained to understand the relevant background of artificial intelligence; Compact artificial intelligence theory, method and technology; Establish the consciousness of system thinking, such as experimental design, exploration and discovery, analysis and synthesis, innovation and entrepreneurship, collaboration and communication, learning and adaptation, and engineering management; Skilled application of algorithmic programming, perceptual modeling, cognitive reasoning, carbon source accounting and other technical means, design and implement artificial intelligence system technology application engineering. In the aspect of sports, students are trained to master the knowledge of physical health and physical training skills, and develop sports hobbies and lifelong habits. In terms of aesthetic education, students should be cultivated to find, appreciate and create beauty and give full play to their positive energy. In the aspect of labor education, students are trained to establish the concept of labor glory, respect for labor, love labor, love public welfare, and be diligent in practice. Through systematic learning, engineering practice and social participation, students will grow into new engineering talents qualified for engineering design, technology development and service, operation management and maintenance, optimal decision support and other work of artificial intelligence products or systems.

Graduates should obtain knowledge and competences as follows:

( 1 ) Knowledge: Possess solid theoretical foundation and have the technical knowledge and reasoning abilities required for new engineering majors, including basic knowledge of mathematics and the humanities, perception - cognitive reasoning - learning basic knowledge, etc; perceive the advanced basic knowledge such as the core, artificial intelligence algorithm - deep learning - a Python program design.

( 2 ) Skills: Build strong personal technical skills, including digital image modeling, speech analytical modeling, modeling of natural language processing, text analysis, modeling and solving design problems such as expression, experimental observation and data processing ability, system thinking ability to deal with complicated AI application engineering.

( 3 ) Quality: Keep good professional ethics, including the innovation practice, inspire entrepreneurial awareness, the pursuit of life-long learning, consciously self-discipline self-confidence, sticking to engineering ethics and showing the general situation view raise integrity quality.

( 4 ) Career accomplishments (including career development and professional competence, etc.) : Have the sense of responsibility for undertaking the engineering work and creating material wealth for the society under the

social environment of the future AI era. Have the ability to condense corporate culture, propose development plans, and develop technological innovation, organize research team work in the intelligent manufacturing enterprise and AI industrial services business environment. Preliminarily perceive such experience and awareness as conceive-design-implementation-run (CDIO) AI manufacturing and services, etc.

## II. Major direction

Artificial intelligence

## III. Graduation Requirements

According to the training objectives of the major and the needs of social development, the graduation ability requirements and indices decomposition of the major at the present stage are clarified:

Graduation Requirements	Indices
<b>Requirement 1:</b> Engineering knowledge: Students have a solid knowledge of mathematics, natural science, and systematically master the basic system control engineering foundation and professional knowledge in the field of artificial intelligence, with which to solve can be all kinds of complex knowledge problems used in such sphere. in artificial intelligence complex engineering problems.	1-1. Students should understand and grasp the basic knowledge of the natural sciences such as mathematics, physics, and have a certain sense of modern science and technology methodology.
	1-2. Students should understand and grasp the basic theory and basic method of artificial intelligence, understanding the basic engineering knowledge, the system of artificial intelligence and computational thinking ability
	1-3. In curriculum assessment, students should be able to practice and graduation design (paper), the application of mathematical and natural science, engineering, and professional knowledge to solve complex engineering problem in artificial intelligence systems and applications
<b>Requirement 2:</b> Problem analysis: Students can apply the basic principles of mathematics, natural science and engineering science to perform abstract analysis and identification, expression of modeling, and to analyze complex engineering problems through literature research to obtain valid conclusions.	2-1. Students should be able to pass the application of mathematics, natural science, basic theory and method of artificial intelligence, analysis and recognition of the complexity of the actual engineering application problems related to, and make clear description and presentation.
	2-2. Students should have a variety of literature retrieval ways for references of ability, have the ability of the relevant literature review and analysis at the same time
	2-3. Students are able to apply the principles of mathematics, natural science, artificial intelligence to analyze, express, reason and verify the complex engineering problems in course assessment, training practice and graduation design(thesis), etc.
<b>Requirement 3:</b> Design/develop solutions: Students can design solution to complex engineering problems in the field of artificial intelligence solutions, design hardware and software to meet the specific needs, module or algorithm process, and can	3-1. Students should master the basic design principle of artificial intelligence technology application problems and the method, and can design reasonable solution to complex engineering problems related.
	3-2. Students should be able to understand and master the artificial intelligence technology on the design methodology and application of complex engineering problems related to the solution of the method, and practice certain creative thinking ability in the process of solution.

reflect innovation consciousness in the design process, considering the social, health, safety, legal, cultural and environmental factors.	3-3. Students should be able to establish comprehensive considering the social and cultural, health and safety, ethics and legal consciousness, environment and development, and many other factors in course examination, practice and graduation design (paper).
Requirement 4: Scientific research: Be able to study complex problems of artificial intelligence software and hardware, based on scientific principles in the field of artificial intelligence and using the scientific method and system engineering, including designing experiments, analyzing and interpreting data, and obtaining reasonable and effective conclusion through information synthesizing.	4-1. Students should understand and master the basic theory and method of artificial intelligence, and understand the professional research method on the basis of science and technology methodology.
	4-2. Students should be able to use relevant theory and methods of complex computer science and artificial intelligence engineering problems to establish quantitative or qualitative models and perform analysis and comparison; Be able to grasp the original data collection and processing method, parameter analysis method, testing methods of the result of experiment and comprehensive analysis methods.
	4-3. Students should be able to research and develop solution of complex engineering problems. through a certain number of design experiments, simulation experiments and research project or a project in course examination, practice and graduation design (paper).
Requirement 5: Application of advanced tools: Students have ability to develop, select and use appropriate technology, software, hardware and system resources, modern engineering research and development tools and information retrieval tools to solve complex engineering problems in the field of artificial intelligence, including the prediction and simulation of complex engineering problems, and be able to understand its limitations.	5-1. Students should be able to skillfully use programming method, environment and tools, including software development of integration environment, the experimental data analysis tools, modeling and simulation tools, etc.
	5-2. Students should be able to master the application of artificial intelligence system for environment and development tools, etc., including Python, artificial intelligence and machine learning environment computing platform, deep learning platform, etc.
	5-3. Students should be able to analysis and compare, predict and simulate certain complex engineering problems by selecting and using the methods of artificial intelligence, platform and tools, and understand and describe the limitations of the solutions.
Requirement 6: Engineering and society: Students can conduct reasonable analysis based on the background knowledge of , evaluate artificial intelligence in engineering practice and complex engineering solutions to problems of social, health, safety, and legal and the influence of culture, and understand the social responsibility.	6-1. Students should understand the basic knowledge of society, safety, health, ethics, law, etc. and understand its interaction with artificial intelligence application system, especially the artificial intelligence ethics.
	6-2. Students should be able to analyze, compare and evaluate the aspects of humanities and society, health and safety, ethics and law, in the process of solving complex engineering problems, through which presenting their obligations, integrity and responsibility.
Requirement 7: Environment and sustainable development: Students have ability to understand and evaluate effects of complex engineering problems in the field of artificial intelligence on environment, and the social sustainable development.	7-1. Students should have basic knowledge of the environment and the sustainable development and consciousness and understand the artificial intelligence and its application to the current social environment and the natural environment, and the influence of sustainable development and importance.
	7-2. Students can understand complex engineering problems of any engineering practices which are likely to impact environment and sustainable development, and they can perform analysis and evaluation on the impact of the solutions for specific problems on environment and sustainable development.

<p>Requirement 8: Professional norms: Students have humanities, social science literacy, and social sense of responsibility, be able to understand and keep professional ethics and norms, in the process of engineering practice and fulfill responsibility.</p>	<p>8-1. Humanistic quality: have a scientific outlook on the world, life and values, can correctly understand the individual's position in the society, history and natural environment, and have a sense of responsibility to promote national rejuvenation and social progress.</p>
	<p>8-2. Professional norms: Understand the professional nature and responsibilities of engineering technicians, understand and abide by engineering professional ethics and norms in the practice of artificial intelligence engineering, and fulfill corresponding responsibilities.</p>
<p>Requirement 9: Individual and team: Students can undertake the roles as individual, team member, and the head respectively under the multidisciplinary background.</p>	<p>9-1. Students should understand the importance of respecting individual rights and interests, understand the relationship between the individual, group, and society, understand the interests of the individual and team unity, and the role of the head and team members.</p>
	<p>9-2. Students should attend certain cross-faculty or cross-professional organizations or competitions and other activities, or participate in a certain engineering practice, social practice, public welfare activities, research, etc. and be able to play their role in them.</p>
<p>Requirement 10: Communication: Students have artificial intelligence related to complex engineering problems and to communicate effectively with the industry peers and the social public communication, including writing reports and designing documents, speech presentation, clear expression or responding to commands, and have a certain international vision to under the background of cross-cultural communication and exchanges.</p>	<p>10-1. Students should have professional foreign language literature reading and retrieval ability in artificial intelligence, have professional foreign language communication and writing skills, and with international vision, they can communicate under the cross-cultural background.</p>
	<p>10-2. Students should be able to communicate effectively with classmates, peers and the public on certain complex engineering solutions to problems in a variety of teaching and practice, including writing reports and designing documents, speech presentation, articulation of ideas, actuating response to questions and so on.</p>
<p>Requirement 11: Project management: Students are able to understand and grasp the principle of project management and methods of economic decision, applied in a multidisciplinary environment.</p>	<p>11-1. Students should understand and grasp the general project planning and management, project decision-making and economy, the basic knowledge and method and the current related industries have a certain understanding of artificial intelligence.</p>
	<p>11-2. In curriculum assessment, students should be able to understand and apply project management theory and multidisciplinary knowledge such as economic decision method to solve complex engineering problems in course assessment, practical links, scientific and technological activities, and graduation design (thesis).</p>
<p>Requirement 12: Independent and everlasting learning perseverance: Students have the consciousness of constant and continuous learning and the ability to adapt to the development of artificial intelligence technology.</p>	<p>12-1. Students should be able to understand the importance and necessity of autonomous learning and lifelong learning, to master a certain method of autonomous learning and life-long learning.</p>
	<p>12-2. Students should be able to demonstrate the consciousness of independent learning and lifelong learning in the professional teaching and practice, and reflect the ability of autonomous learning and life-long learning.</p>

## The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives			
	Educational Objectives 1	Educational Objectives 2	Educational Objectives 3	Educational Objectives 4
1: Engineering Knowledge	√			
2: Problem Analysis	√	√		
3: Design/Development Solutions	√	√		
4: Research		√		√
5: Use Modern Tools		√		√
6: Engineering and Society		√	√	√
7: Environment and Sustainable Development			√	√
8: Career Planning			√	√
9: Individuals and Teams			√	√
10: Communication			√	√
11: Project Management			√	√
12: Lifelong Learning			√	√

### IV. Major Subject

Electronic Information

### V. Core Courses

Basis of circuit analysis, Digital electronic technology, Analog electronic technology, Automatic control theory, Introduction to cognitive psychology, Introduction to Neurobiology, Fundamentals of Artificial Intelligence, Machine learning, Natural language processing, Computer vision and pattern recognition, Digital image processing, Neural network and deep learning, Intelligent system design etc.

### VI. Educational System

The basic undergraduate education system is 4 years, and the flexible study period is 3-6 years according to the credit system management.

### VII. Confer Degrees

Students should complete at least 169 credits before graduation. Students who meet the requirement of degree granting conforming to the Bachelor's Degree Awarding Regulations of Shenyang University of Chemical Technology (revised in March 2017), can be awarded bachelor's degree in engineering.

## VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit requirement	Subtotal	Proportion (%)
General Education	General Education (Compulsory)	Ideological and Political Courses	Compulsory	17.0	41.5	24.6
		Foreign Language Courses		12.0		
		Computer Courses		2.5		
		Military and Safety Courses		2.0		
		Labor and Sport Education		5.0		
		Innovation and Entrepreneurship		2.0		
		Mental Health		1.0		
	General Education (Optional)	Aesthetic Education(400)	Optional	2.0	8.0	4.7
		China and the world(500)		2.0		
		Four Histories(600)		1.0		
		Economic Management(700)		1.0		
Traditional Culture(900)		2.0				
General education practice course	Military training	Practice	2.0	2.0	1.18	
Discipline Education	Basic Courses	Public basic class	Compulsory	58.5	66.0	
		Professional foundation				
	Basic Practice Sessions	-	Practice	7.5		
Specialized Education	Core Courses	-	Compulsory	14.5	43.5	69.52
	Optional Courses	-	Optional	4.0		
	Specialized Practice Sessions	-	Practice	25.0		
Competency Development	Individualized Courses	-	Compulsory (or Practice)	8.0	8.0	
Extracurricular practice	Extracurricular General Education Practice	Culture and Society Practice	Extracurricular Practice	4.0		
		Mentally and Physically Practice				
		Foreign Language Proficiency Training Practice				
	Extracurricular Characteristic Practice	Innovative Training		4.0		
		Innovation Competition				
		Chuangke activities				
	Career Education	Growth Planning Courses		1.0		
Total/Proportion					169	100



## 九、人工智能专业教学进程表

### Table of Teaching Schedule for Artificial Intelligence Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H.	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
通识教育课 General Education	思政类 Ideological and Political Courses		0710093001	思想道德与法治    Ideological Morality and the Rule of Law	3.0	48	32			16		2								
			0710053001	中国近现代史纲要    Outline of Chinese Contemporary and Modern History	3.0	48	32			16	2									
			0710123001	习近平新时代中国特色社会主义思想概论    Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8				3						
			0710103001	马克思主义基本原理*    Basic Principles of Marxism*	3.0	48	32			16				2						
			0710133001	毛泽东思想和中国特色社会主义理论体系概论*    Mao Zedong Thought and Theory of Socialism with Chinese Characteristics *	3.0	48	32			16				2						
			0710012301	形势与政策    Current Situation and Policies	2.0	64	64				1	1	1	1	1	1	1	1		
	外语类 Foreign Language Courses		0211003101	大学外语I    College English I	3.0	48	48				3									
			0211003201	大学外语II*    College English II*	3.0	48	48					3								
			0241003301	大学外语III    College English III	3.0	48	48						3						五选一	

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C.H.	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes			
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八				
											1st	2nd	3rd	4th	5th	6th	7th	8th				
通识教育课 General Education	必修 Compulsory	外语类 Foreign Language Courses	0241003301	大学外语III（进阶英语）    College English III（Advanced English CET 6-Orientated）	3.0	48	48						3									
				大学外语III（英语口语表达与交流）    College English III（English Oral Expression and Communication）	3.0	48	48							3								
				大学外语III（跨文化交际）    College English III（Intercultural Communication）	3.0	48	48							3								
				大学外语III（英语写作表达与交流）    College English III(English Writing Expression and Communication）	3.0	48	48							3								
			0241003401	大学外语IV*   College English IV*	3.0	48	48								3							
				大学外语IV（进阶英语）    College English IV（Advanced English CET 6-Orientated）	3.0	48	48								3							
				大学外语IV（英语口语表达与交流）    College English IV（English Oral Expression and Communication）	3.0	48	48								3							
				大学外语IV（跨文化交际）    College English IV（Intercultural Communication）	3.0	48	48								3							
		大学外语IV（英语写作表达与交流）    College English IV（English Writing Expression and Communication）		3.0	48	48								3								
		计算机类 Computer Courses	1511372002	C 语言程序设计  C Language Programming	2.5	44	32			12			2									
		军事安全类 Military and Safety	0710081001	军事理论   Military Theory	1.0	16	16						2									

五选一



课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C.H.	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八			
											1st	2nd	3rd	4th	5th	6th	7th	8th			
合计 Total					51.5																
学科平台课 Discipline Education	必修 Compulsory	数学与自然科学类 Natural Science & Mathematics	0310004101	高等数学 I*   Advanced Mathematics I*	4.5	80	72			8	6										
			0310005201	高等数学 II*   Advanced Mathematics II*	5.5	96	88			8		6									
			0310032001	线性代数   Linear Algebra	2.0	32	32					3									
			0310042001	概率论与数理统计   Probability and Mathematical Statistics	2.0	32	32								2						
			1510251002	复变函数   Function of Complex Variable	1.5	24	24						2								
			0310063101	大学物理I*   University physicsI*	3.0	48	46	2					3								
			0310063201	大学物理II*   University physicsII*	3.0	48	46	2						3							
		工程基础类 Foundation Engineering	1510163002	电路分析基础*   Basis of Circuit Analysis	3.5	56	56						4								
			1510913002	模拟电子技术*   Analog Electronic Technology*	3.5	60	48	12						3							
			1510923002	数字电子技术*   Digital Electronic Technology*	3.5	60	48	12							3						
			1511364002	自动控制原理*   Principle of Automatic Control*	4.0	68	56	8	4							4					
			1513272002	算法与数据结构*   Algorithms and Data Structures*	2.5	44	32		12						3						
			1526982002	计算机组成原理*   Computer Composition Principle*	2.5	42	36	6									3				



课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C.H.	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八			
										1st	2nd	3rd	4th	5th	6th	7th	8th			
学科平台课 Discipline Education	实践 Practice	1512212032	电子工艺实习   Electronic Process Practice	2.0	48	集中	2					+2								
		1511422022	工程数学实践   Engineering Mathematics Practice	2.0	48	分散						4								
		1510150012	电路分析基础实验   Circuit Analysis Experiment	0.5	12	分散				2										
		1511261022	电子设计与制作   Electronic Design and Production	1.0	24	集中	1						+1							
		小计 Subtotal			7.5	180														
合计 Total				66.0																
专业教育课 Specialized Education	必修 Compulsory	1519093002	计算机视觉与模式识别*    Computer Vision and Pattern Recognition *	3.0	52	40		12							3					
		1511862002	机器学习  Machine Learning	2.0	34	28		6					2							
		1524852002	数字图像处理*   Digital Image Processing*	2.5	44	32	12									3				
		1519063002	自然语言处理*   Natural Language Processing*	3.0	52	40		12								3				
		1519071002	智能制造与低碳经济发展    Intelligent Manufacturing and Low-carbon Economy Development	1.0	16	16								2						
		1519083002	低碳工业智能设计与管理技术   Low Carbon Industrial Intelligent Design and Management Technology	3.0	52	40		12								3				
	小计 Subtotal			14.5	250	196	12	42	0	0	0	0	0	4	12	0	0			
	选修	1537242002	Matlab 程序设计   Matlab Programming	2.0	36	24		12			2									

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C.H.	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
						讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八		
										1st	2nd	3rd	4th	5th	6th	7th	8th		
专业教育课 Specialized Education	Optional	1534302002	信号与系统II   Signals and Systems II	2.0	34	28	6					2							
		1537042002	计算机网络与通信技术   Computer Network and Communication Technology	2.0	32	32									2				
		1538563002	ZigBee 技术应用及无线传感器网络   ZigBee Technology and Wireless Sensor Networks	3.0	52	40	12							3					
		1534872002	语音信号处理   Speech Signal Processing	2.0	36	24		12						2					
		1536972002	嵌入式系统原理   Embedded System Principle	2.0	36	24	12									2			
		1534863002	大数据原理与技术   Principle and Technology Big Data	3.0	56	32		24								4			
		1534962002	C#程序设计   C# Programming	2.0	36	24		12						2					
		1534932002	面向对象程序设计   Object-oriented Programming Design	2.0	36	24		12				2							
		小计 Subtotal				20.0	354	252	30	72	0	0	0	6	0	7	8	0	0
	(修读要求 Fill in the Study Requirements) 4.0																		
	实践 Practice	1519132022	Python 数据分析实训   Python Training in Data Analysis	2.0	48	分散	2						2						
		1519152022	机器学习综合课程设计   Comprehensive Course Design of Machine Learning	2.0	48	分散	2								2				
		1519142022	人工智能专业实训   Artificial Intelligence Professional Training	2.0	48	分散	2							2					
		1519162002	智能系统设计   Intelligent System Design	2.0	48	分散	2									2			CDIO 课程

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H.	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
专业教育课 Specialized Education			1519111032	认识实习   Cognition Practice	1.0	24	分散						2							
			1519182032	生产实习   Production Practice	2.0	48	集中	2										+2		
			1519191042	毕业设计（论文）   Graduation Design (Thesis)	14.0	336	集中	16											+14	
			小计 Subtotal			25.0	600													
	合计 Total					43.5														
			1519103002	神经网络与深度学习*   Neural Network and Deep Learning*	3.0	52	40		12					3						
			1519202022	智能感知系统综合实践   Integrated Practice of Intelligent Perception Systems	2.0	48	分散	2										2		
			1519172022	人工智能综合课程设计   Comprehensive Course Design of Artificial Intelligence	2.0	48	分散	2										2		
			1519122022	情商与领导力特色实训    EQ and Leadership Characteristics Training	1.0	24	分散				2									
			小计 Subtotal			8.0	172													
						(修读要求 Fill in the Study Requirements) 8.0														
	总计 Sum					169						16.5	30.5	28	33	15.5	17.5	12	17	
	课外 环节 Extracurricular	课外实践 Extracurricular practice	人文社会实践 Culture and Society Practice	1511701032	社会调查   Social Survey	0.5	12				12								0.5	分散
			身心健康社会实践 Mentally and	0410050751	课外体育锻炼   Extracurricular Physical Exercise	0.5	12				12								0.5	分散



课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H.	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
	Physically Practice		2640030011	劳动教育实践   Labour Education Practice	0.5	12				12		0.5							分散	
			0510070311	心理健康辅导   Mental Health Counseling	0.5	12				12							0.5		分散	
		成长规划类 Growth Planning Courses		1510271312	职业规划与就业指导   Career Planning and Employment Guidance	1.0	40	40					2	2	2	2				
		外语技能实践类 Foreign Language Proficiency Training Practice		0210010011	外语技能实践（初级）   Foreign Language Proficiency Training Practice (elementary)	2.0	48				48				2					二选一
				0210020011	外语技能实践（高级）   Foreign Language Proficiency Training Practice (advanced)	2.0	48				48				2					
		能力与创新实践 Capability and Innovation Practice		1511712022	大学生素质拓展与创新实践   Quality Development and Innovation Practice	4.0	96				96	1~8 学期依据《沈阳化工大学创新创业实践学分认定办法》由创新创业学院认定								分散
		小计 Subtotal																		

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5,课程名称中画\*为考试课。

Note: “Cre. (Credits)”, “T.C.H. (Total Credit Hours)”, “Lec. (Lecture)”, “Exp. (Experiment)”, “Pro. (Programming)”, “Pra. (Practice)”.

## 十、人工智能专业学士学位课程一览表

### A list of bachelor's degree programs in Artificial Intelligence

课程类别 Course Type	模块名称 Modules	序号 No.	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester	
通识教育课 General Education	政治理论 Political Theory	1	0710103001	马克思主义基本原理* Elementary Theory of Marxism*	3.0	4	
		2	0710133001	毛泽东思想和中国特色社会主义理论体系概论* Mao Zedong Thought and Theory of Socialism with Chinese Characteristics *	3.0	4	
学科平台课 Discipline Education	数学 Mathematics	3	0310014101	高等数学 I* Advanced Mathematics I*	4.5	1	
	物理 Physics	4	0310063101	大学物理I* University Physics I*	3.0	2	
	工程基础 Foundations of Engineer	5	1510063002	电路分析基础* Basis of Circuit Analysis*	3.5	2	
		6	1510923002	数字电子技术* Digital Electronic Technology*	3.5	4	
		7	1513272002	算法与数据结构* Algorithms and Data Structures*	2.5	3	
		8	1511364002	自动控制原理* Principle of Automatic Control*	4.0	4	
	专业基础 Professional Foundation	9	1511852002	人工智能基础 Fundamentals of Artificial Intelligence	2.0	4	
		10	1519021002	人工智能专业外语 Artificial Intelligence Professional Foreign Language	1.0	5	
		11	1514892002	数字信号处理* Digital Signal Processing*	2.5	4	
	专业教育课 Specialized Education	人工智能类 Artificial Intelligence	12	1519053002	计算机视觉与模式识别* Computer Vision and Pattern Recognition*	3.0	6
			13	1519063002	自然语言处理* Natural Language Processing*	2.5	6
14			1519153002	神经网络与深度学习* Neural Network and Deep Learning*	3.0	5	
15			1511862002	机器学习 Machine Learning	2.0	5	

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》

### 十一、全学程实践环节周历安排 Weekly Calendar of all Practice Sessions

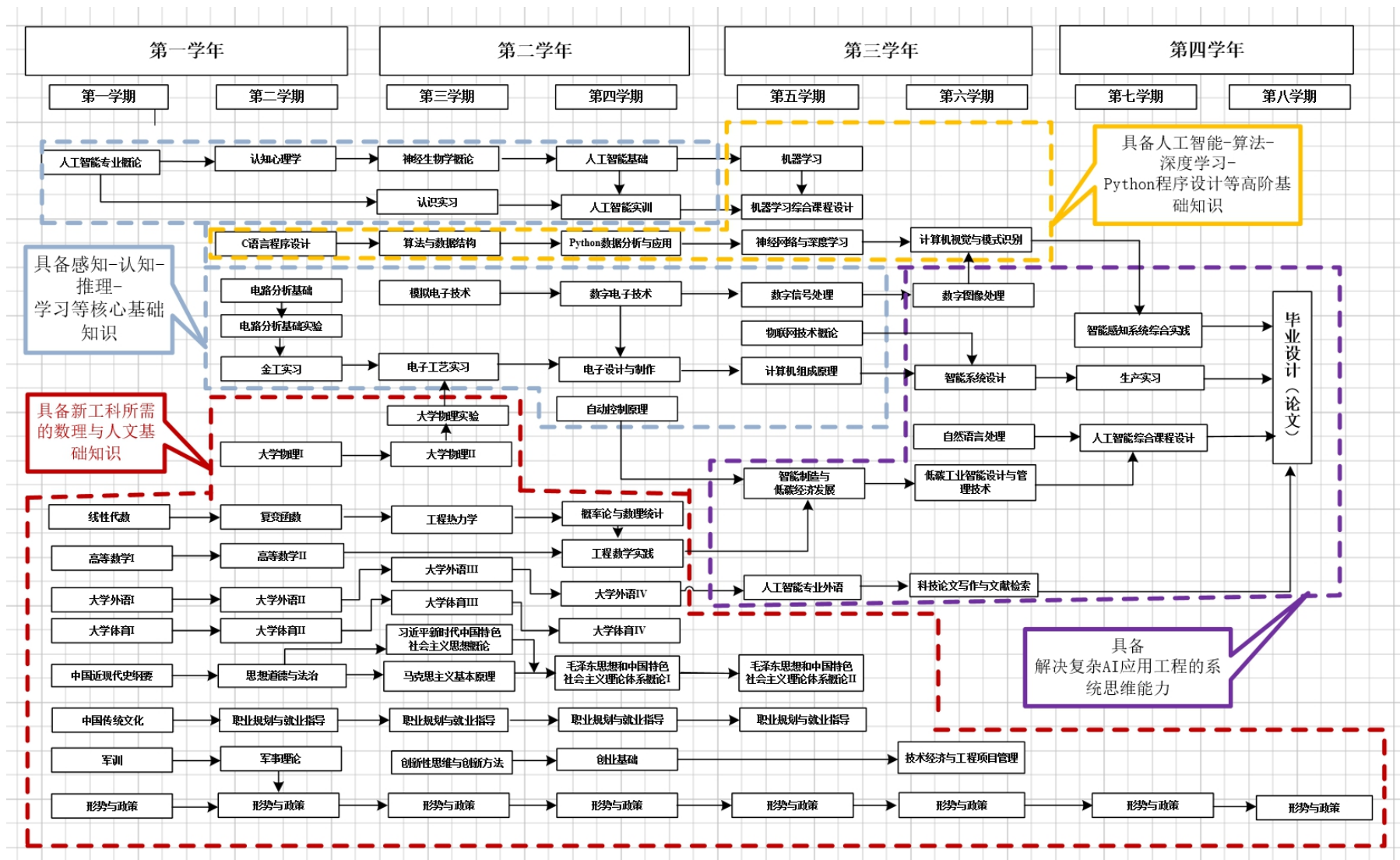
学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注
一		☆	☆															::	::	·		军训
二													※					::	::	·		金工实习
三												P	P					::	::	·		电子工艺 实习
四								P	P			P						::	::	·		外语技能 实践；电子 设计与制 作
五																		::	::	·		
六																		::	::	·		
七			/	/														::	::	·		生产实习
八	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=						毕业设计

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#### 符号说明(Symbol Description):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P 各类实训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼ 认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计(论文)||Graduation Project(Thesis)    ·小学期||Primary Term

## 十二、课程体系配置图 Curriculum System Configuration Diagram



十三、主要课程与毕业能力要求关系矩阵图(相关性强 H, 相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements ( High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																												
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	9.1	9.2	10.1	10.2	11.1	11.2	12.1	12.2
思想道德与法治    Ideological Morality and the Rule of Law																				M	H								
中国近现代史纲要    Outline of Chinese Contemporary and Modern History																				M									
习近平新时代中国特色社会主义思想概论    Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																				M									
马克思主义基本原理*    Basic Principles of Marxism *																				H									
毛泽东思想和中国特色社会主义理论体系概论 *   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics *																				M									
形势与政策    Current Situation and Policies																					M			M					
大学外语I-IV    College English I-IV														M										M					M
C 语言程序设计    C Language Programming													H																M
军事理论    Military Theory																					M								
安全教育    Safety Education										M							M						M						
劳动教育    Labour Education																					M	M							



课程 (Courses)	毕业能力要求 (Graduation Requirements)																												
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	9.1	9.2	10.1	10.2	11.1	11.2	12.1	12.2
计算机组成原理   Computer Composition Principle										M																			
工程热力学    Engineering Thermodynamics							M											M											
数字信号处理*   Digital Signal Processing										M																			
人工智能专业概论   Professional Introduction to Artificial Intelligence																M		M											M
认知心理学   Cognitive Psychology	M																												
神经生物学概论   Overview of Neurobiology	M																												
人工智能专业外语   Artificial Intelligence Professional Foreign Language					M																				H	H			
物联网技术概论   Introduction to Internet of Things Technology									M																				
科技论文写作与文献检索   Science and Technology Thesis Writing and Literature Retrieval					H																				H				M
大学物理实验   University Physics Experiment											M		M																
金工实习   Metalworking Practice																						M		M					
生产实习   Production Practice																	M	L	M							M			M
毕业设计 (论文)   Graduation Design (Thesis)			M			M			M			M				M												M	
电子工艺实习   Electronic Process Practice																							M						
工程数学实践   Engineering Mathematics Practice						M																		M					











# 沈阳化工大学本科培养方案

## 信息工程学院

专业名称：自动化

专业代码：080801

制 定：郭小萍

审 核：孔晓光

审 定：于三三

批 准：金志浩

2021年8月

# 自动化专业培养方案

## 一、培养目标

本专业培养能在流程工业等领域从事自动化系统的分析、设计、开发、运行及管理等方面工作的高素质应用型工程技术人才。

毕业 5 年后的学生：

(1) 具有扎实的理论基础，具备适应自动化工程技术发展及职业拓展需求的能力，能够综合运用数学等自然科学、专业知识及交叉学科知识，分析自动化及相关领域中的复杂工程问题并提供系统性解决方案；

(2) 能够运用现代工具理解和解决复杂流程工业过程自动控制系统的分析、设计、集成和服务等实际工程问题；

(3) 具有高度的社会责任感、健全的人格、良好的人文科学素养、和谐包容的团队精神、有效的沟通与表达能力和工程项目管理能力，在工程实践中能综合考虑法律、环境与可持续性发展等因素，具有坚持公众利益优先的素质；

(4) 具有广阔的国际视野，主动适应不断变化的国内外形势和环境，能够通过多种学习渠道更新知识，形成终生学习的习惯。

## 二、专业方向

过程控制。

## 三、毕业要求

根据本专业人才培养目标以及我校自动化学科多年的人才培养经验，从适应社会发展的需求出发，明确现阶段本专业的毕业能力要求及其指标点分解：

毕业能力要求	指标点
毕业要求 1： 工程知识：掌握数学、自然科学、工程基础和自动化专业知识，能够运用其理论和方法解决流程工业信息化、自动化相关的复杂工程问题。	1-1.能将数学、自然科学、工程基础和专业知识运用到复杂工程问题的恰当表述中。
	1-2.能针对一个系统或过程建立合适的数学模型，并利用恰当的方法进行求解。
	1-3.能将工程基础和专业知识用于流程工业过程的判别和分析。
	1-4.能将工程基础和专业知识用于流程工业过程的设计、控制和改进。
毕业要求 2： 问题分析：能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究分析流程工业信息化、自动化相关的复杂工程问题，以获得有效结论。	2-1.能运用数学、自然科学和工程科学的基本原理，识别流程工业信息化、自动化相关的复杂工程问题中的关键环节。
	2-2.能通过建立数学模型、稳定性分析、系统集成分析、基于工艺和设备运行操作指标分析等方法正确表达流程工业信息化、自动化相关的复杂工程问题。
	2-3.能通过文献研究来分析流程工业信息化、自动化相关的复杂工程问题，以获得有效结论。
毕业要求 3： 设计/开发解决方案：在综合考虑社会、健康、安全、法律、文化以及环境等因素的前提下，能够针对流程工业信息化、自动化相关的复杂工程问题设计解决方案，设计满足特定需求的系统、单元（部件），并能够在设计环节中体现创新意识。	3-1.能够根据用户需求确定设计目标，并能够在安全、环境、法律等现实约束条件下，对设计方案的可行性进行研究。
	3-2.能够通过建模进行工艺计算，集成单元过程进行流程控制设计，并对流程过程设计方案进行优选，体现创新意识。
	3-3.掌握单元、系统等自动化工程设计知识，能够应用其针对流程工业信息化、自动化相关的复杂工程问题设计解决方案。

<p>毕业要求 4:</p> <p>研究:能够基于科学原理并采用科学方法对流程工业信息化、自动化相关的复杂工程问题进行研究,包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。</p>	4-1.能够基于专业理论,根据对象特性,选择研究路线。
	4-2.能够基于先进控制方法、过程监控方法等对流程工业信息化、自动化相关的复杂工程问题设计实验方案,开展实验,分析与解释数据。
	4-3.能够针对流程工业信息化、自动化相关的复杂工程问题进行控制系统应用研究,并通过信息综合得到合理有效的结论。
<p>毕业要求 5:</p> <p>使用现代工具:掌握文献检索、资料查询以及运用现代信息技术获取相关信息的基本方法,能够针对流程工业信息化、自动化相关的复杂工程问题,开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具,包括对流程工业信息化、自动化相关的复杂工程问题的预测与模拟,并能够理解其局限性。</p>	5-1.掌握文献检索、资料查询以及运用现代信息技术获取相关信息的基本方法。
	5-2.能正确开发、选择与使用仿真工具、人机界面集成工具等技术、资源,对流程工业信息化、自动化相关的复杂工程问题进行预测与模拟。
	5-3.在解决流程工业信息化、自动化相关的复杂工程问题实践中提高现代工具的应用能力,并能够理解其局限性。
<p>毕业要求 6:</p> <p>工程与社会:能够基于流程工业信息化、自动化相关的背景知识进行合理分析,评价专业工程实践和复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响,并理解应承担的责任。</p>	6-1.掌握社会、健康、安全、法律以及文化等方面的相关知识,能够基于流程工业信息化、自动化相关的背景知识进行合理分析。
	6-2.亲身体验并评价工程实践和工程方案对社会、健康、安全、法律以及文化的影响,理解在流程工业信息化、自动化相关工程实践中应承担的责任。
<p>毕业要求 7:</p> <p>环境和可持续发展:能够理解和评价针对流程工业信息化、自动化相关的复杂工程问题的工程实践对环境、社会可持续发展的影响。</p>	7-1.理解和亲身体验针对流程工业信息化、自动化相关的复杂工程问题的工程实践对环境、社会可持续发展的影响。
	7-2.运用环境与可持续发展等相关法律法规分析、评价针对流程工业信息化、自动化相关的复杂工程问题的工程实践对环境、社会可持续发展的影响。
<p>毕业要求 8:</p> <p>职业规范:具有人文社会科学素养、社会责任感,能够在流程工业信息化、自动化的工程实践中理解并遵守工程职业道德和规范,履行责任。</p>	8-1.培养良好的世界观、人生观;了解国家与社会发展。
	8-2.具有良好的人文社会科学素养、社会责任感。
	8-3.理解工程师的职业性质和责任;在流程工业信息化、自动化的工程实践中遵守工程职业道德和规范,并履行责任。
<p>毕业要求 9:</p> <p>个人和团队:能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。</p>	9-1.能够在多学科背景下的团队中承担个体角色并发挥个体优势。
	9-2.能够在多学科背景下的团队中承担团队成员角色并发挥团队协作精神。
	9-3.能够在多学科背景下的团队中承担团队负责人角色并发挥管理能力。
<p>毕业要求 10:</p> <p>沟通:能够就流程工业信息化、自动化相关的复杂工程问题与业界同行及社会公众进行有效沟通和交流,包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令,并具备一定的国际视野,能够在跨文化背景下进行沟通和交流。</p>	10-1.具备外语交流能力,具有一定的国际视野,能够在跨文化背景下进行沟通和交流。
	10-2.能够熟练阅读专业外语文献资料,就流程工业信息化、自动化相关的复杂工程问题与业界同行及社会公众有效地进行口头和书面的信息交流。
<p>毕业要求 11:</p> <p>项目管理:理解并掌握工程管理原理与经济决策方法,并能在多学科环境中应用。</p>	11-1.理解并掌握一定的工程管理原理与经济决策方法。
	11-2.能够应用工程管理原理与经济决策方法对流程工业信息化、自动化相关的复杂工程问题进行有效分析和综合评价。
<p>毕业要求 12: 终身学习:具有自主学习和终身学习的意识,有不断学习和适应发展的能力。</p>	12-1.掌握终身学习的语言工具和计算机工具,具有自主学习能力,能够通过自主查阅资料,获取解决问题的知识和方法。
	12-2.充分认识到流程工业信息化、自动化相关的工程领域的快速发展以及自主学习、终身学习的重要性,具有健康良好的心理、身体素质,以适应工作中的各种任务。

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。

## 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标			
	培养目标 1	培养目标 2	培养目标 3	培养目标 4
1: 工程知识	√			√
2: 问题分析	√	√		
3: 设计/开发解决方案	√	√		
4: 研究		√		√
5: 使用现代工具		√		√
6: 工程与社会		√	√	
7: 环境和可持续发展			√	
8: 职业规范			√	
9: 个人和团队			√	
10: 沟通			√	√
11: 项目管理			√	
12: 终身学习			√	√

### 四、主干学科

控制科学与工程

### 五、专业核心课程

电路分析基础、数字电子技术、模拟电子技术、微机原理及应用、自动控制原理、现代控制理论、过程检测技术与传感器、过程建模技术、过程控制工程、计算机控制技术。

### 六、修业年限

本科基本学制 4 年，弹性学习年限 3-6 年，按照学分制度管理。

### 七、授予学位

学生应至少修满 170 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者，可授予工学学士学位。按照形成性评价规范、达到人才培养方案规定辅修要求的学生，获沈阳化工大学自动化专业新工科（实验班）辅修证书。

## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例(%)
通识教育课	通识教育必修课	思政类	必修	18	42.5	24.85
		外语类		12		
		计算机类		2.5		
		军事安全类		2		
		劳动体育类		5		
		创新创业类		2		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	2	8	4.68
		中国与世界(500)		2		
		四史(600)		1		
		经济管理类(700)		1		
		传统文化(900)		2		
	通识教育实践课	军训	实践	2	2	1.17
	学科平台课	学科基础课程	公共基础类	必修	56.5	62
专业基础类						
	学科实践课程	-	实践	5.5		
专业教育课	专业核心课程	-	必修	16.5	48.5	
	专业选修课程	-	选修	3		
	专业实践课程	-	实践	29		
能力拓展课	专业特色课程	-	必修 (或实践)	8	8	
课外环节	课外通识实践	人文社会实践	课外实践	4		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
	生涯教育	成长规划类		1		
辅修课程	-	-	必修	24		
总学分/比例					171	100



# Automation Major 2021 Undergraduate Education Program

## I. Educational Objectives

This major trains high-quality applied engineering and technical personnel who can be engaged in the analysis, design, development, operation and management of automation systems in process industries and other fields.

Students 5 years after graduation:

(1) Having a solid theoretical foundation, and the ability to adapt to the development of automation engineering technology and career development needs: being able to use mathematics and other natural science, professional knowledge and interdisciplinary knowledge to analyze complex engineering problems in automation and related fields and provide systematic solutions;

(2) Being able to use modern tools to understand and solve practical engineering problems such as analysis, design, integration and service of complex process of industrial process and automatic control system;

(3) Having a high sense of social responsibility, sound personality, good humanity literacy, harmonious and inclusive team spirit, effective communication and expression ability and project management ability. In engineering practice, graduates can comprehensively consider factors such as law, environment and sustainable development, and have the quality of giving priority to public interests;

(4) Having a broad international vision: actively adapting to the changing situation and environment at home and abroad: being able to update knowledge through a variety of learning channels to form the habit of lifelong learning.

## II. Major direction

Process control

## III. Graduation Requirements

According to the talent training objectives of this major and the many years of talent training experience of Automation Discipline in our university, starting from the needs of social development, it is clear that the graduation requirements and indexes of this stage, which are as follows:

Graduation Requirements	Indices
Requirement 1: master the professional knowledge of mathematics, natural science, engineering foundation and automation, and be able to use its theories and methods to solve complex engineering problems related to informationization and automation of process industry.	1.1 Be able to apply mathematics, natural science, engineering foundation and professional knowledge to the proper expression of complex engineering problems.
	1.2 Be able to establish appropriate mathematical model for a system or process and solve it with appropriate methods.
	1.3 Be able to apply engineering foundation and professional knowledge to the process of identification and analysis in process industry.
	1.4 Be able to apply engineering foundation and professional knowledge to the design, control and improvement of process industry.

Requirement 2: The basic principles of mathematics, natural science and engineering science can be applied to identify, express and analyze complex engineering problems related to informatization and automation of process industry through literature research, so as to obtain effective conclusions.	2.1 Be able to use the basic principles of mathematics, natural science and engineering science to identify the key links in complex engineering problems related to process industry informatization and automation.
	2.2 Be able to correctly express complex engineering problems related to informatization and automation of process industry by establishing mathematical model, stability analysis, system integration analysis, technical process and equipmental operation index analysis, etc.
	2.3 Be able to analyze complex engineering problems related to informatization and automation of process industry through literature research, so as to obtain effective conclusions.
Requirement 3: On the premise of comprehensive consideration of social, health, safety, legal, cultural and environmental factors, we can design solutions for complex engineering problems related to informationization and automation of process industry, design systems and units (components) that meet specific needs, and embody innovative consciousness in the design process.	3.1 Be able to determine the design objectives according to the needs of users, and be able to study the feasibility of the design scheme under the realistic constraints of safety, environment and law.
	3.2 Be able to carry out process calculation through modeling, integrate unit process to make process control design, and optimize process design scheme to reflect innovative consciousness.
	3.3 Master the knowledge of unit and system automation engineering design, and be able to apply it to design solutions for complex engineering problems related to process industry informatization and automation.
Requirement 4: Based on scientific principles and scientific methods, we can study complex engineering problems related to informationization and automation of process industry, including designing experiments, analyzing and interpreting data, and obtaining reasonable and effective conclusions through information synthesis.	4.1 Be able to choose research routes based on professional theory and object characteristics.
	4.2 Be able to design experimental schemes, carry out experiments, analyze and interpret data for complex engineering problems related to process industry informatization and automation based on advanced control methods and process monitoring methods.
	4.3 Be able to study the application of control system for complex engineering problems related to process industry informatization and automation, and get reasonable and effective conclusions through information synthesis.
Requirement 5: master the basic methods of document retrieval, data query and using modern information technology to obtain relevant information, and be able to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for complex engineering problems related to informationization and automation of process industry, including forecasting and simulating complex engineering problems related to informationization and automation of process industry, and be able to understand their limitations.	5.1 Master the basic methods of document retrieval, data inquiry and by the use of modern information technology obtain relevant information.
	5.2 Be able to correctly develop, select and use simulation tools, human-computer interface integration tools and other technologies and resources, and predict and simulate complex engineering problems related to process industry informatization and automation.
	5.3 Improve the application ability of modern tools in solving complex engineering problems related to process industry informatization and automation, and understand its limitations.
Requirement 6: based on the background knowledge related to informatization and automation of process industry, it can make reasonable analysis, evaluate the impact of	6.1 Master the relevant knowledge of society, health, safety, law and culture, and be able to make reasonable analysis based on the background knowledge of process industry informatization and automation.

professional engineering practice and complex engineering problem solutions on society, health, safety, law and culture, and understand the responsibilities to be undertaken.	6.2 Personally experience and evaluate the impact of engineering practice and engineering schemes on society, health, safety, law and culture, and understand the responsibilities in process industry informatization and automation related to engineering practice.
Requirement 7: to understand and evaluate the impact of engineering practice on the sustainable development of environment and society, aiming at complex engineering problems related to informatization and automation of process industry.	7.1 Understand and experience the impact of engineering practice on the sustainable development of environment and society on complex engineering problems related to process industry informatization and automation.
	7.2 Analyze and evaluate the impact of engineering practice on the sustainable development of environment and society by using relevant laws and regulations such as environment and sustainable development.
Requirement 8: with humanistic and social science literacy and social responsibility, be able to understand and abide by professional ethics and norms of engineering and fulfill responsibilities in the engineering practice of informatization and automation of process industry.	8.1 Cultivate a good world outlook and outlook on life; Understand national and social development.
	8.2 Have good humanity and social science literacy and sense of social responsibility.
	8.3 Understand the professional nature and responsibilities of engineers; In the process industry informatization and automation engineering practice, abide by the engineering professional ethics and norms, and fulfill the responsibility.
Requirement 9: being able to assume the roles of individual, team member and person in charge in a team with multidisciplinary background.	9.1 Be able to play an individual role and give full play to individual advantages in a multidisciplinary team.
	9.2 Be able to play the role of team member and demonstrate team spirit in a multidisciplinary team.
	9.3 Be able to play the role of team leader and demonstrate management ability in a multidisciplinary team.
Requirement 10: being able to effectively communicate and communicate with industry peers and the public on complex engineering issues related to informatization and automation of process industry, including writing reports and design manuscripts, making statements, expressing or responding to instructions clearly, having a certain international perspective, and being able to communicate and communicate in a cross-cultural context.	10.1 Have the ability of foreign language communication, have a certain international vision, and be able to communicate and exchange in a cross-cultural context.
	10.2 Be able to skillfully read professional foreign language literature, and effectively exchange oral and written information with industry peers and the public on complex engineering issues related to process industry informatization and automation.
Requirement 11: understand and master the principles of project management and economic decision-making methods, and be able to apply them in multidisciplinary environment.	11.1 Understand and master certain engineering management principles and economic decision-making methods.
	11.2 Be able to effectively analyze and comprehensively evaluate complex engineering problems related to informatization and automation of process industry by applying engineering management principles and economic decision-making methods.
Requirement 12: have the awareness of autonomous learning and lifelong learning, and have the ability of continuous learning and adapting to development.	12.1 Master the language tools and computer tools of lifelong learning, have the ability of self-learning, and be able to obtain the knowledge and methods of solving problems through self-access to information.
	12.2 Fully realize the rapid development of process industry informatization and automation related to engineering fields, as well as the importance of autonomous learning and lifelong learning, and have good psychological and physical quality to adapt to various tasks in the work.

## The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives			
	Educational Objectives 1	Educational Objectives 2	Educational Objectives 3	Educational Objectives 4
1: Engineering Knowledge	√			√
2: Problem Analysis	√	√		
3: Design/Development Solutions	√	√		
4: Research		√		√
5: Use Modern Tools		√		√
6: Engineering and Society		√	√	
7: Environment and Sustainable Development			√	
8: Career Planning			√	
9: Individuals and Teams			√	
10: Communicate			√	√
11: Project Management			√	
12: Lifelong Learning			√	√

### IV. Major Subject

Control Science and Engineering

### V. Core Courses

Fundamentals of Circuit Analysis, Electronic Technology, Microcomputer Principles and Application, Electric Drive Fundamentals, Power Electronics, Automatic Control Theory, Modern Control Theory, Process Detecting Technology and Sensor, Process Modelling Technology, Process Control Engineering, Computer Control Technology etc.

### VI. Educational System

The basic length of undergraduate education is 4 years, and the flexible study period is 3-6 years. It is managed according to the credit system.

### VII. Confer Degrees

Students should complete at least 170 credits before graduation. The Bachelor of engineering degree can be granted to those who meet the degree awarding requirements of the relevant regulations on the awarding of bachelor's degree for graduates of Shenyang University of Chemical Technology (revised in March 2017). According to the formative evaluation criteria, students who meet the minor requirements specified in the talent

training program have obtained the minor certificate of new engineering (experimental class) of automation major of Shenyang University of chemical technology.

## VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit Requirements	Subtotal	Proportion (%)
General Education	Subject Platform Course General Education Compulsory Course	Ideological and Political Education	Compulsory	17	41.5	24.41
		Foreign Languages		12		
		Computer		2.5		
		Military Security		2		
		Labor Sports		5		
		Innovation and Entrepreneurship		2		
		Mental Health		1		
	General Education Elective Subjects	Aesthetic Education (400)	Elective	2	8	4.71
		China and the World (500)		2		
		Four Histories (600)		1		
		Economic Management(700)		1		
		Traditional Culture (900)		2		
	General Education Practice Course	Military Training	Practice	2	2	1.18
Discipline Education	Basic Subject Courses	Public Basic Class	Compulsory	56.5	62	
		Professional Foundation				
	Subject Practice course	-	Practice	5.5		
Specialized Education	Professional Core Courses	-	Compulsory	16.5	48.5	69.70
	Professional Elective Courses	-	Elective	3		
	Professional Practice Courses	-	Practice	29		
Competency Development	Professional Characteristic Courses	-	Compulsory (or Practice)	8	8	
Extracurricular Links	Extracurricular General Knowledge Practice	Humanistic Social Practice	Extracurricular Practice	4		
		Physical and Mental Health Practice				
		Foreign Language Skills Practice				
	Innovation and Entrepreneurship Practice	Innovation Training		4		
		Innovation Competition				
		Maker Activities				
Career Education	Growth Planning	1				
Minor Courses	-	-	Compulsory	24		
Total Credits / Proportion					170	100

## 九、自动化专业教学进程表

### Table of Teaching Schedule for Automation Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学 分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八	
											1st	2nd	3rd	4th	5th	6th	7th	8th	
通识教育课 General Education	必修 Compulsory	思政类 Ideological and Political Courses	0710093001	思想道德与法治    Ideological Morality and the Rule of Law	3.0	48	32			16		2							
			0710053001	中国近现代史纲要   Outline of Chinese Contemporary and Modern History	3.0	48	32			16	2								
			0710103001	马克思主义基本原理*    Basic Principles of Marxism*	3.0	48	32			16			2						
			0710133001	毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics *	3.0	48	32			16			2						
			0710123001	习近平新时代中国特色社会主义思想概论 Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8				3					
			0710012301	形势与政策   Current Situation and Policies	2.0	64	64				1	1	1	1	1	1	1	1	
		0211003101	大学外语I   College EnglishI	3.0	48	48				3									

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes			
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th				
通识教育课 General Education	必修 Compulsory	外语类 Foreign Language Courses	0211003201	大学外语II*   College English II*	3.0	48	48					3										
			0241003301	大学外语III   College English III	3.0	48	48							3								
				大学外语III（进阶英语）    College English III(Advanced English CET 6-Orientated)	3.0	48	48							3								
				大学外语III（英语口语表达与交流）    College English III（English Oral Expression and Communication）	3.0	48	48							3								
				大学外语III（跨文化交际）    College English III（Intercultural Communication）	3.0	48	48							3								
				大学外语III（英语写作表达与交流）    College English III（English Writing Expression and Communication）	3.0	48	48							3								
			0241003401	大学外语IV*   College English IV*	3.0	48	48								3							
				大学外语IV（进阶英语）    College EnglishIV（Advanced English CET 6-Orientated）	3.0	48	48								3							
				大学外语IV（英语口语表达与交流）    College EnglishIV（English Oral Expression and Communication）	3.0	48	48								3							

五选一

五选一



课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
通识教育课 General Education	必修 Compulsory	外语类 Foreign Language Courses	0241003401	大学外语IV（跨文化交际） ∥ College English IV（Intercultural Communication）	3.0	48	48													
				大学外语IV（英语写作表达与交流） ∥ College English IV（English Writing Expression and Communication）	3.0	48	48													
		计算机类 Computer Courses	1511372002	C 语言程序设计 ∥C Language Programming	2.5	44	32			12		3								
		军事安全类 Military and Safety Courses	0710081001	军事理论 ∥Military Theory	1.0	16	16					2								
			1510261302	安全教育 ∥Safety Education	1.0	16	16					1	1	1	1	1	1	1		
		劳动体育类 Labor and Sport Education	2640021001	劳动教育 ∥Labour Education	1.0	16	16					2								
			0410011101	大学体育I ∥College Physical EducationI	1.0	36		36				2								
			0410021201	大学体育II ∥College Physical Education II	1.0	36		36				2								
			0410031301	大学体育III ∥College Physical Education III	1.0	36		36					2							
			0410041401	大学体育 IV ∥College Physical Education IV	1.0	36		36						2						
		创新创业类 Innovation and Entrepreneurs hip courses	1557011002	创造性思维与创新方法 ∥Creative Thinking and Innovative Methods	1.0	16	16						2							
			1740011001	创业基础 ∥Entrepreneurial Foundation	1.0	16	16							2						

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八			
											1st	2nd	3rd	4th	5th	6th	7th	8th			
通识教育课 General Education	必修 Compulsory	心理健康类 Mental Health Courses	0510041001	大学生心理与健康教育   Mental and Health Education for College Students	1.0	16	16					2									
		小计 Subtotal				41.5	780	552	144	12	72	11	16	9	13	5	2	2	1	41.5	
	选修 Optional	包括 5 个模块，分别是经济管理类（1.0）、美育类（2.0）、四史（1.0）、传统文化（2.0）、中国与世界（2.0），每学期最多选修 2 门课程。It includes five modules, namely, economic management (1 credit), aesthetic education (2 credits), four history (1 credit), traditional culture (2 credits), China and the world (2 credits), and a maximum of 2 courses per semester.																			
		小计 Subtotal				8.0	128	128				1	1	1	1	1	1	1	1		
	实践 Practice	0415102011	军训   military training			2.0	48				48	+2								集中	
	合计 Total				51.5	956	680	144	12	120	14	1	10	14	6	3	3	2	51.5		
学科平台课 Discipline Education	必修 Compulsory	数学与自然科学类 Mathematics & Natural Science	0310004101	高等数学 I*   Advanced Mathematics I*	4.5	80	72				8	6									
			0310005201	高等数学 II*   Advanced Mathematics II*	5.5	96	88				8		6								
			0310032001	线性代数    Linear Algebra	2.0	32	32					3									
			0310042001	概率论与数理统计   Probability and Statistics	2.0	32	32								2						
			1519501002	面向信息科学的离散数学   Discrete Mathematics in Information Science	1.0	16	16								2						
			1510251002	复变函数   Function of Complex Variable	1.5	24	24								2						



课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八			
											1st	2nd	3rd	4th	5th	6th	7th	8th			
学科平台课 Discipline Platform Education	必修 Compulsory	专业基础类 Professional Basic Courses	1511392002	仿真技术   Simulation Technology	2.0	36	24		12				2								
			1511851002	自动化专业外语    Specialty English for Automation	1.5	24	24						2								
			1511051002	自动化专业概论   Introduction to Automation	1.0	18	12	6			2										
			1511461002	科技论文写作与文献检索   Literature Searching and Scientific Papers Writing	1.0	16	16								2						
			1511364002	自动控制原理*   The Principle of Automatic Control*	4.0	68	56	8	4					4							
			1511383002	现代控制理论    Modern Control Theory	3.0	52	40	8	4					3							
			小计 Subtotal				56.5	950	840	68	26	16	11	17	11	15	10	2	0	0	56.5
	实践 Practice			0310081011	大学物理实验   Physical Experiment of College	1.0	24	6	18				3								
				2110071031	金工实习   Metalworking Practice	1.0	24			24			+1							集中	
				1511422022	工程数学实践   Engineering Mathematics Practice	2.0	48	8	40						4						分散
				1510150012	电路分析基础实验   Basic Experiment of Circuit Analysis	0.5	12		12				2								分散
				1511261022	电子设计与制作    Electronic Design and Production	1.0	24		24						+1						集中
				小计 Subtotal				5.5	132	14	118	0	0	0	3	3	5	0	0	0	5.5
	合计 Total					62	1082	854	186	26	16	11	20	14	20	10	2	0	0	62	

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th		
专业教育课 Specialized Education	必修 Compulsory	1511423002	过程建模技术*   Process Modeling Technology*	3.0	52	40	8	4						3					
		1511503002	过程控制工程*   Process Control Engineering*	3.5	60	48	12								4				
		1511413002	计算机控制技术*   Computer Control Technology*	3.0	52	40	10	2							3				
		1511882002	集散控制系统(DCS)   Distributed Control System	2.5	44	32	12								2				
		1511892002	可编程控制器原理及应用    The Principle and Application of Programmable Controller	2.0	34	28	6								2				
		1513042002	过程检测技术与传感器   Process Detection Techniques and Sensors	2.5	42	36	6							3					
		小计 Subtotal				16.5	284	224	54	6	0	0	0	0	0	5.5	11	0	0
	选修 Optional	1537042002	计算机网络与通信技术    Computer Network and Communication Technology	2.0	32	32									2				
		1532242002	电气控制技术   Electrical Control Technology	2.0	34	28	6						2						
		1532252002	工程电磁场   Engineering Electromagnetic Field	2.0	34	28	6						2						
		1533992002	机器人控制   Robot Control	2.0	36	24	12								2				
		1533112002	单片机应用基础   MCU Application Basis	2.0	34	28	6						2						

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th		
专业教育课 Specialized Education (续)	选修 Optional	1534863002	大数据原理与技术    Big Data Principle and Technology	3	56	32		24							4				
		1534302002	信号与系统II   Signals and Systems II	2.0	34	28	6					2							
		小计 Subtotal		14.0	260	200	36	24	0	0	0	2	4	2	8				
		修读要求 Fill in the Study Requirements		3	48	48										3			3
	实践 Practice	1511362022	控制工程课程设计   Course Design of Control Engineering	2.0	48		48										+2		集中
		1511402022	工程实训   Engineering Practice	2.0	48		48										+2		集中 CDIO 课程
		1511382022	过程建模技术课程设计   Course Design of Process Modeling Technology	2.0	48		48								4				分散
		1512212032	电子工艺实习   Electronic Process Practice	2.0	48		48					+2							集中
		1511372022	计算机控制系统集成设计   Integrated Design of Computer Control System	2.0	48		48										+2		集中
		1511412022	自动化装置综合实训   Comprehensive Practice and Training of Automation Devices	2.0	48		48								4				分散
		1511351032	认识实习   Cognition Practice	1.0	24		24					4							分散
		1511162032	生产实习   Production Practice	2.0	48		48										+2		集中

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学 分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
						讲 课 Lec.	实 验 Exp.	上 机 Pro.	课 外 实 践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th		
专业教育课 Specialized Education (续)	实践 Practice	1511721042	毕业设计(论文)   Graduation Design (or Thesis)	14.0	336		336										+1 4	集中	
		小计 Subtotal			29	696	0	696	0	0	0	0	6	0	0	8	8	14	29
	合计 Total				48.5	1028	272	750	6	0	0	0	6	0	6	19	8	17	48.5
能力拓展课 Competency Development	必修或实践 Compulsory or Practical	1511852002	人工智能基础   Fundamentals of Artificial Intelligence	2.0	34	28		6				2							
		1511862002	机器学习   Machine Learning	2.0	34	28		6					2						
		1511872002	Python 数据分析与应用   Python Data Analysis and Application	2.0	36	24		12					2						
		1511392022	仿真课程设计   Course Design of Simulation	2.0	48		48						4						分散
		小计 Subtotal			8	152	80	48	24	0	0	0	0	8	2	0	0	0	8
		(此处填写修读要求 Fill in the Study Requirements) 8.0																	
课外环节 Extracurricular	课外实践 Extracurricular practice	人文社会实践 Culture and Society Practice	1511701032	社会调查   Social Survey	0.5	12											0.5	分散	
		身心健康社会 实践 Mentally and Physically Social Practice	0410050751	课外体育锻炼   Extracurricular Physical Exercise	0.5	12												0.5	分散
			2640030011	劳动教育实践   Labour Education Practice	0.5	12													分散
			0510070311	心理健康辅导   Mental Health Counseling	0.5	12												0.5	分散

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八	
											1st	2nd	3rd	4th	5th	6th	7th	8th	
课外环节 Extracurricular	外语技能实践类 Foreign Language Proficiency Training and Practice	0210010011	外语技能实践（初级） Foreign Language Proficiency Training Practice (elementary)	2.0	48				48				2					分散 (二选一)	
		0210020011	外语技能实践（高级） Foreign Language Proficiency Training and Practice (advanced)			48				2									
	课外实践 Extracurricular practice	能力与创新实践 Capability and Innovation Practice	1511712022	大学生素质拓展与创新实践 Quality Development and Innovation Practice for College Students	4.0	96				96	1~8 学期依据《沈阳化工大学创新创业实践学分认定办法》由创新创业学院认定								分散
	成长规划类 Growth Planning Courses	职业规划与就业指导 Career Planning and Employment Guidance	1510271312		1.0	40	40				1					1			
小计 Subtotal					9	232	40	0	0	192	0	0.5	4	2	1	0	1.5	0	9

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5，课程名称中画\*为考试课。

Note: "Cre. (Credits)", "T.C.H. (Total Credit Hours)", "Lec. (Lecture)", "Exp. (Experiment)", "Pro. (Programming)", "Pra. (Practice)".



辅修 课程 Minor course	必修 Compulsory	1511802	调查与实验设计方法    The Method of Investigation and Experiment Design	2.0	44	8	36			4								
		1511812	全新思维    A Whole New Mind	2.0	44	8	36					4						
		1511822	机器学习    Machine Learning	2.0	44	8	36							4				
		1511832	情商 2.0 实战    Emotional Intelligence 2.0 Practice	2.0	44	8	36			4								
		1511842	领导力 2.0 实战    Leadership 2.0 Practice	2.0	44	8	36			4								
		1511852	新控制工程师    Creativity and Innovation for control Engineers	2.0	44	8	36					4						
		1511862	一年制项目    Year-long project teams	2.0	44	8	36							4	4			
		1511872	发现自动化之旅    Discover the Journey of Automation	2.0	44	8	36			4								
		1511882	创新的艺术    The Art of Innovation	2.0	44	8	36					4						
		1511892	创业的轨迹    Entrepreneurship Trajectory	2.0	44	8	36							4				
		1511902	Python 程序设计    Python programming	2.0	44	8	36							4				
		1511912	社会实践能力提升    The Promotion of Social Practice Ability	2.0	44	8	36											
		小计 Subtotal				24	528	96	432	0	0	4	4	2	4	4	4	2
总计 Sum				170	3218	1886	1128	68	136	25	36	30	42	24	24	11	19	170

## 十、自动化专业学士学位课程一览表

### A list of bachelor's degree programs in Automation Major

课程类别 Course Type	模块名称 Modules	序号 No.	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester	
通识教育课 General Education	政治理论 Political Theory	1	0710103001	马克思主义基本原理* Elementary Theory of Marxism*	3	4	
		2	0710133001	毛泽东思想和中国特色社会主义理论体系概论* Mao Zedong Thought and Theory of Socialism with Chinese Characteristics *	3	4	
学科平台课 Discipline Education	数学 Mathematics	3	0310014101	高等数学I* Advanced Mathematics I*	4.5	1	
	物理 Physics	4	0310063101	大学物理I College Physics I	3	2	
	工程基础 Engineering Foundation	5	1510063002	电路分析基础* Fundamentals of Circuit Analysis*	3.5	2	
		6	1510923002	数字电子技术* Digital Electronic Technology*	3.5	4	
		7	1514992002	微机原理及应用 Microcomputer Principle and Application	2.5	5	
	专业基础 Professional Foundation	8	1511851002	自动化专业外语 Specialty English for Automation	1.5	5	
		9	1511392002	仿真技术 Simulation Technology	2	4	
		10	1511364002	自动控制原理* The Principle of Automatic Control*	4	4	
		11	1511383002	现代控制理论 Modern Control Theory	3	5	
	专业教育课 Professional Education	过程控制 Process Control	12	1511503002	过程控制工程* Process Control Engineering*	3.5	6
			13	1511413002	计算机控制技术* Computer Control Technology*	3.0	6
14			1511423002	过程建模技术* Process Modeling Technology*	3	5	
15			1511532002	集散控制系统(DCS) Distributed Control System	2.5	6	

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》

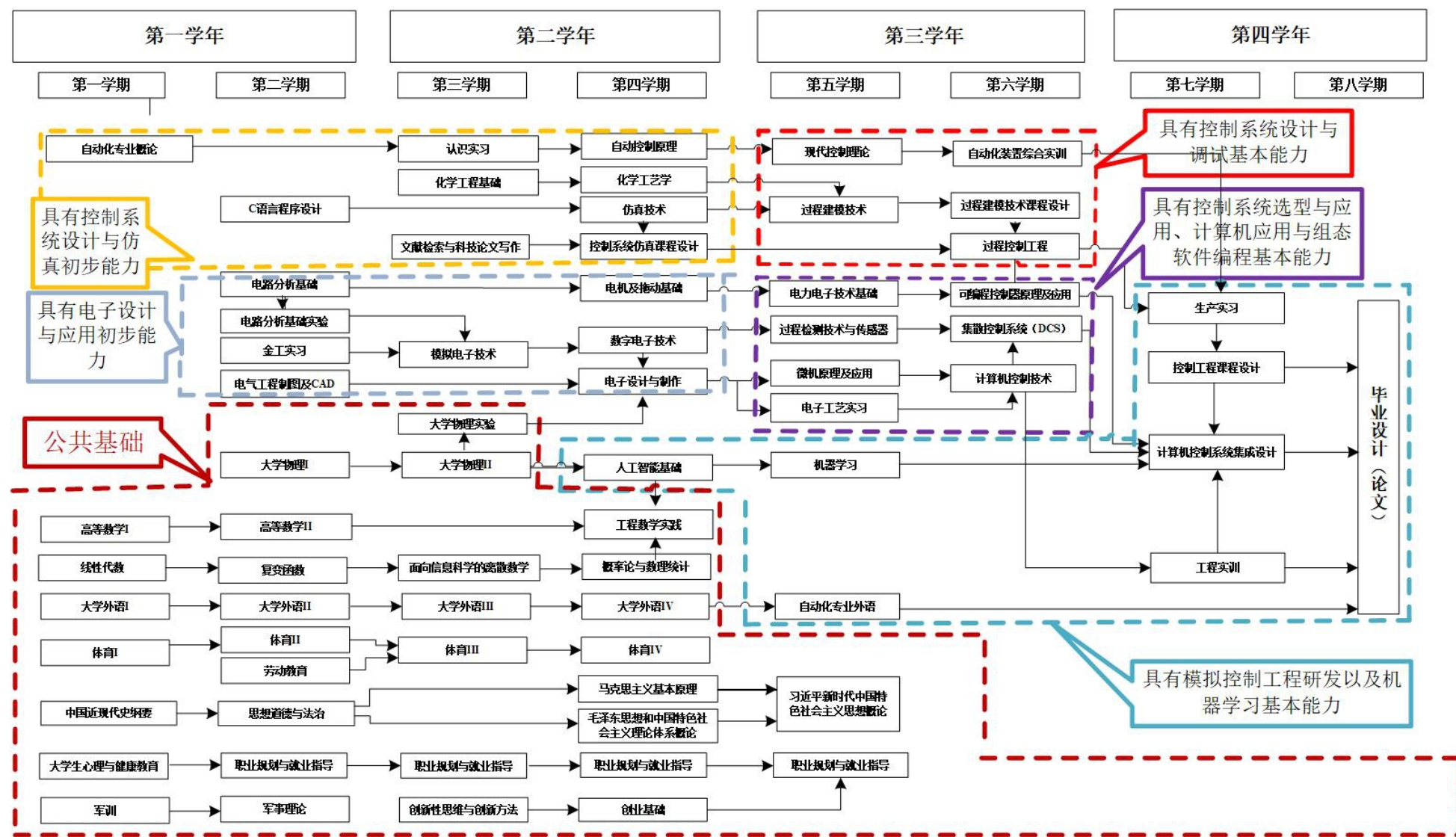
### 十一、全学程实践环节周历安排 Weekly Calendar of all Practice Sessions

学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注	
一		☆	☆															::	::	·			
二													※					::	::	·	·		金工实习
三																		::	::	·			
四												△						::	::	·	·		电子设计与制作
五												P	P					::	::	·			电子工艺实习
六																		::	::	·	·		
七	△	△	/	/			△	△	△	△											·		控制工程课程设计；生产实习；计算机控制系统集成设计；工程实训
八	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=						毕业设计

#### 符号说明(Symbol Introduction):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P 各类实训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼ 认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计(论文) ||Graduation Project(Thesis)    ·小学期||Mini-term

## 十二、课程体系配置图 Curriculum System Configuration Diagram



十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements (High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	11.1	11.2	12.1	12.2	
马克思主义基本原理概论*    Basic Principal of Marxism*																						M											
中国近现代史纲要   Outline of Chinese Contemporary and Modern History																						M											
思想道德与法治    Ideological Morality and the Rules of Law																						M	L	M									
毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*																						M											
习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																						M											
大学外语I-IV   College English I-IV																												M					M
C 语言程序设计   C Programming Language															M																	L	
大学体育I-IV   College Physical Education I-IV																										M							M
高等数学I-II    Advanced Mathematics I-II	M	M	L	L																													

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																	
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	11.1	11.2	12.1	12.2		
线性代数    Linear Algebra	L	M	L	L	M																													
概率论与数理统计    Probability and Mathematical Statistics		M			M																													
复变函数   Function of Complex Variable		M			M																													
面向信息科学的离散数学   Discrete Mathematics in Information Science		L			M																													
大学物理I-II    College Physics I-II	M		L																															
电气工程制图及 CAD    Electrical Engineering Drawing and CAD															M																			
电路分析基础*    Fundamentals of Circuit Analysis*		M				M																												
模拟电子技术*   Analog Electronic Technology*	M																																	
数字电子技术*   Digital Electronic Technology*		M																																
微机原理及应用    Microcomputer Principle and Application	M																																	
仿真技术   Simulation Technology												M			H																			
化学工程基础   Unit Operations of Chemical Engineering								M				L																						
自动控制原理*   The Principle of Automatic Control*			M		H							M																						
现代控制理论    Modern Control Theory				M		M						H																			M			

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	11.1	11.2	12.1	12.2	
自动化专业概论    Introduction to Automation																		M		L													M
电力电子技术基础    Fundamentals of Power Electronics			M							M																							
电机及拖动基础    Fundamental of Electric Drive			M		L																												
自动化专业外语    Specialty English for Automation														M														M	M				
过程控制工程*    Process Control Engineering*				M						H		M																					
计算机控制技术*    Computer Control Technology*				M								H																					
过程建模技术*    Process Modeling Technology*		M			H							M																					
集散控制系统(DCS)    Distributed Control System											H				M																		
可编程控制器原理及应用    The Principle and Application of Programmable Controller											M				H																		
过程检测技术与传感器    Process Detection Techniques and Sensors				M							H																						
职业规划与就业指导    Career Planning and Employment Guidance																							L	M									
形势与政策   Current Situation and Policies								M														L						M					







# 沈阳化工大学本科培养方案

## 信息工程学院

专业名称：物联网工程

专业代码：080905

制 定：张延华

审 核：孔晓光

审 定：于三三

批 准：金志浩

2021 年 8 月

# 物联网工程专业培养方案

## 一、培养目标

本专业培养适应物联网技术发展需要的能在物联网工程与应用研发领域从事物联网系统分析、设计、开发、应用、管理等方面工作，具有较强的工程实践能力与创新能力的高级工程技术人才。

本专业毕业生具有如下目标预测：

(1) 较好地掌握马克思主义、毛泽东思想和邓小平理论，拥护党的基本路线，热爱祖国，遵纪守法，学风严谨，品行端正，身心健康，勇于追求真理，有较强的事业心和献身科学的精神，积极为社会主义现代化建设服务。

(2) 具有扎实的理论基础，具备适应物联网领域发展的专业能力和专业视野，能够运用数学、自然科学、专业知识以及交叉学科知识，对物联网及相关领域的复杂工程问题的解决方案进行分析和设计。(专业知识)

(3) 具有在企业与社会环境下，运用现代工具对物联网及相关领域的信息获取、传输、处理和系统集成等工程领域进行分析、设计、研究、开发和应用的能力。(工程能力)

(4) 具有高度的社会责任感和道德修养、健全的人格、良好的心理素质和人文科学素养和包容的团队精神，有效的沟通与表达能力和工程项目管理能力，在工程实践中能综合考虑法律、环境与可持续发展等因素，具有坚持公众利益优先的素质。(综合素质)

(5) 具有广阔的国际视野，主动适应不断变化的国内外形势和环境，能够通过多种学习渠道更新知识，能够适应物联网技术的发展动态以及职业发展需求，形成终生学习习惯，实现能力和技术水平的提升。

(就业领域职业发展)

## 二、专业方向

物联网工程应用与数据集成

## 三、毕业要求

毕业能力要求及其指标点分解：

毕业能力要求	指标点
毕业要求 1： 工程知识：掌握数学、自然科学、工程基础和物联网专业知识用于解决复杂工程设计、研发、制造和应用的问题。	1-1.能够将数学、自然科学、工程基础和专业知识运用到复杂工程问题的恰当表述中。
	1-2.能够将工程基础和专业知识用于数据采集、传输和智能应用。
	1-3.能将工程基础和专业知识用于物联网系统单元的设计、研发与分析。
	1-4.综合运用工程基础和专业知识解决物联网工程的信息获取、传输和智能处理的集成应用。
毕业要求 2： 问题分析：能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究来分析物联网工程设计、集成和应用	2-1.能够运用数学、自然科学和工程科学的基本原理，识别物联网工程及相关领域的数据采集、传输、处理等单元设计、研发及应用系统的复杂工程问题中的关键环节。
	2-2.能够通过数据模拟分析、设备运行操作过程数据采集、数据集成等指标正确表达物联网工程的关键环节单元设计、研发及应用系统的复杂工程问题。

中的复杂工程问题,以获得有效结论。	2-3.能够通过文献研究来分析物联网工程及相关领域的数据采集、集成单元设计、研发及应用系统的复杂工程问题,以获得有效结论。
毕业要求 3: 设计/开发解决方案:在综合考虑社会、健康、安全、法律、文化以及环境等因素的前提下,能够针对物联网的复杂工程问题设计解决方案,设计满足特定需求的系统和单元,并能够在设计环节中体现创新意识。	3-1.能够在综合考虑社会、健康、安全、环境、法律等现实约束条件下,对物联网工程中 RFID、传感器等采集模块及应用系统的复杂工程问题设计解决方案。 3-2.能够根据用户的特定需求,设计合理的物联网工程集成方案及应用系统。 3-3.能够综合考虑社会、健康、安全、环境、法律等现实约束条件下,通过对物联网工程集成、研发及应用系统设计方案进行优化,体现创新意识。
毕业要求 4: 研究:能够基于科学原理并采用科学方法对物联网工程设计、研发和应用中的复杂工程问题进行研究,包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。	4-1.能够基于专业理论,根据工程对象特性,选择研究路线。 4-2.能够基于科学原理并采用科学方法对物联网工程及相关领域的数据采集、集成及应用系统的复杂工程问题设计实验方案,开展实验,分析与解释数据。 4-3.能够针对物联网工程相关的复杂工程问题进行应用研究,并通过信息综合得到合理有效的结论。
毕业要求 5: 使用现代工具:能够针对物联网工程领域相关复杂工程问题,具有开发、选择与使用恰当技术、资源、现代工程工具和信息技术工具进行工程实践的能力,包括对复杂工程问题的数据采集、分析与预测,并理解其局限性。	5-1.掌握文献检索、资料查询以及运用现代信息技术获取相关信息的基本方法。 5-2.能够正确开发、选择与使用仿真工具、人机界面集成工具等技术、资源,对物联网工程相关的复杂工程问题进行预测与分析。 5-3.在解决物联网工程相关的复杂工程问题实践中提高现代工具的应用能力,并能够理解其局限性。
毕业要求 6: 工程与社会:能够基于物联网工程领域相关背景知识进行合理分析,评价工程实践对社会、健康、安全、法律和文化问题的影响,并理解应承担的责任。	6-1.掌握社会、健康、安全、法律以及文化等方面的相关知识,能够基于物联网工程相关的背景知识进行合理分析。 6-2.亲身体验并评价工程实践和工程方案对社会、健康、安全、法律以及文化的影响,理解在物联网工程相关工程实践中应承担的责任。 6-3.依据社会、健康、安全、法律以及文化等方面的相关知识,设计满足相关要求的复杂工程问题
毕业要求 7: 环境和可持续发展:能够理解和评价物联网相关产品和系统对环境、社会可持续发展的影响,能够构建并实施兼具环境保护和绿色生产效能的工程。	7-1.理解和亲身体验针对物联网工程相关的复杂工程问题的工程实践对环境、社会可持续发展的影响。 7-2.运用环境与可持续发展等相关法律法规分析、评价针对物联网工程相关的复杂工程问题的工程实践对环境、社会可持续发展的影响。 7-3.在设计、研发和综合应用等相关的物联网工程,符合环境保护和绿色生产的要求
毕业要求 8: 职业规范:具有人文社会科学素养、社会责任感,能够在工程实践中理解并遵守工程职业道德和规范,履行责任。	8-1.培养良好的世界观、人生观;了解国家与社会发展。 8-2.树立和践行社会主义核心价值观,理解个人与社会的关系,了解中国国情,明确个人作为社会主义事业建设者所肩负的责任和使命。 8-3.理解工程师的职业性质和责任;在物联网工程实践中遵守工程职业道德和规范,并履行责任。
毕业要求 9: 个人和团队:具有良好的组织和团队协作能力,能够在多学科背景下承担个体、团队成员以及负责人的角色。	9-1.能够在多学科背景下的团队中承担个体角色并发挥个体优势。 9-2.能够在多学科背景下的团队中承担团队成员角色并发挥团队协作精神。 9-3.能够在多学科背景下的团队中承担团队负责人角色并发挥管理能力。
毕业要求 10: 沟通:能够就物联网工程领域相关的复杂工程问题与业界同行	10-1.具备外语交流能力,具有一定的国际视野,能够在跨文化背景下进行沟通和交流。

及社会公众进行有效沟通和交流,包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令,并具备一定的国际视野,能够在跨文化背景下进行沟通和交流。	10-2. 能够熟练阅读专业外语文献资料,就物联网工程相关的复杂工程问题与业界同行及社会公众有效地进行口头和书面的信息交流。
	10-3.能够运用本专业的知识撰写物联网工程报告能力,清晰表达自己的观点,接受并理解业界同行及社会公众的观点。
毕业要求 11: 项目管理:能够理解并掌握工程项目管理和经济决策方法,并能够在多学科工程实践中应用。	11-1.理解并掌握一定的工程管理原理与经济决策分析方法,并进行有效管理。
	11-2. 能够应用工程管理原理与经济决策方法对物联网工程相关的复杂工程问题进行有效分析和综合评价。
	11-3.运用经济决策方法,设计满足其要求物联网工程。
毕业要求 12: 终身学习:能够适应社会发展和实现个体发展的需要,具有自主学习和终身学习的意识,有不断学习、持续学习和适应发展的能力。	12-1. 掌握终身学习的语言工具或计算机工具,具有自主学习能力,能够通过自主查阅资料,获取解决问题的知识和方法。
	12-2. 充分认识到物联网工程相关的工程领域的快速发展以及自主学习、终身学习的重要性,具有健康良好的心理、身体素质,以适应工作中的各种任务。
	12-3.学习和运用所学物联网工程相关的新技术,并运用新技术解决物联网工程问题。

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。

### 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标			
	培养目标 1	培养目标 2	培养目标 3	培养目标 4
1: 工程知识	√			√
2: 问题分析	√	√		
3: 设计/开发解决方案	√	√		
4: 研究		√		√
5: 使用现代工具		√		√
6: 工程与社会		√	√	
7: 环境和可持续发展			√	
8: 职业规范			√	
9: 个人和团队			√	
10: 沟通			√	√
11: 项目管理			√	
12: 终身学习			√	√

#### 四、主干学科

信息获取与物联网工程

#### 五、专业核心课程

信息识别与处理、集成类课群、电路电子类课群、计算机技术类课群、网络和通信技术类课群。

#### 六、修业年限

本科基本学制 4 年，弹性学习年限 3-6 年，按照学分管理制度管理。

## 七、授予学位

学生应至少修满 166 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者，可授予工学学士学位。

## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例(%)
通识教育课	通识教育必修课	思政类	必修	17	41.5	25.0
		外语类		12		
		计算机类		2.5		
		军事安全类		2		
		劳动体育类		5		
		创新创业类		2		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	2	8	4.8
		中国与世界(500)		2		
		四史(600)		1		
		经济管理类(700)		1		
传统文化(900)		2				
通识教育实践课	军训	实践	2	2	1.2	
学科平台课	学科基础课程	公共基础类	必修	73	73	69.0
		专业基础类				
	学科实践课程	-	实践			
专业教育课	专业核心课程	-	必修	11.5	37.5	
	专业选修课程	-	选修	4		
	专业实践课程	-	实践	22		
能力拓展课	专业特色课程	-	必修(或实践)	4	4	
课外环节	课外通识实践	人文社会实践	课外实践	4		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
	生涯教育	成长规划类		1		
总学分/比例					166	100%

# IoT Major 2021 Undergraduate Education Program

## I. Training Objectives

This major cultivates senior engineering and technical personnel who can adapt to the development of Internet of things technology, work in the field of Internet of things engineering and application research and development from the aspects of Internet of things system analysis, design, development, application and management, and have strong engineering practice ability and innovation ability.

Graduates should obtain knowledge and competences as follows:

(1) Have a solid theoretical foundation, professional ability and vision to adapt to the development of the Internet of things, be able to use mathematics, natural science, professional knowledge and interdisciplinary knowledge to analyze and design solutions to complex engineering problems in the Internet of things and related fields.(Professional Knowledge)

(2) Obtain the ability to use modern tools to analyze, design, research, develop and apply the information acquisition, transmission, processing, information integration and other engineering fields of the Internet of things and related fields in the enterprise and social environment.(Engineering Ability)

(3) With a high sense of social responsibility and moral cultivation, sound personality, good psychological quality and humanities literacy and inclusive team spirit, effective communication and expression ability and project management ability, comprehensive consideration of legal, environmental and sustainable development factors in engineering practice, and the quality of adhering to the priority of public interest.(Comprehensive Quality)

(4) It has a broad international vision, actively adapts to the changing situation and environment at home and abroad, updates knowledge through a variety of learning channels, adapts to the development trend of Internet of things technology and the needs of career development, forms lifelong learning habits, and improves ability and technical level.(Career Development )

## II. Major Direction

Engineering Application and Data Integration of Internet of Things

## III. Graduation Requirements

Graduates should obtain knowledge and competences as follows:

Graduation Requirements	Indices
Requirement 1: Engineering knowledge: master the professional knowledge of mathematics, natural science, engineering foundation and Internet of things to solve the problems of complex engineering design, R &	1-1. Be able to apply mathematics, natural science, engineering foundation and professional knowledge to the proper expression of complex engineering problems.
	1-2. Be able to use engineering foundation and professional knowledge for data acquisition, transmission and intelligent application
	1-3. Be able to apply engineering foundation and professional knowledge to the design, development and analysis of IOT system unit.
	1-4.The integrated application of engineering foundation and professional knowledge to



D, manufacturing and application.	solve the information acquisition, transmission and intelligent processing of Internet of things project
<b>Requirement 2:</b> Problem analysis: be able to apply the basic principles of mathematics, natural science and engineering science to identify, express and analyze complex engineering problems in the engineering design, integration and application of the Internet of things through literature research, so as to obtain effective conclusions.	2-1. Be able to use the basic principles of mathematics, natural science and engineering science to identify the key links in the complex engineering problems of unit design, R & D and application system of data acquisition, transmission and processing in the Internet of things engineering and related fields.
	2-2. Be able to correctly express the complex engineering problems of the key link unit design, R & D and application system of the Internet of things project by data simulation analysis, equipment operation process data collection, data integration and other indicators.
	2-3. Be able to analyze the complex engineering problems of data acquisition, integrated unit design, R & D and application system in the Internet of things engineering and related fields by literature research, , so as to obtain effective conclusions.
<b>Requirement 3:</b> Design / development solutions: under the premise of comprehensive consideration of social, health, safety, legal, cultural and environmental factors, we can design solutions for complex engineering problems of the Internet of things, design systems and units to meet specific needs, and embody the sense of innovation in the design process.	3-1. Be able to design solutions to the complex engineering problems of RFID, sensors and other acquisition modules and application systems in the Internet of things project in the comprehensive consideration of social, health, safety, environment, legal and other practical constraints,
	3-2. Be able to design reasonable IOT engineering integration scheme and application system according to the specific needs of users.
	3-3. Be able to comprehensively consider the social, health, safety, environment, legal and other practical constraints, reflecting the sense of innovation by the optimization of IOT engineering integration, R & D and application system design.
<b>Requirement 4:</b> Research: it can study the complex engineering problems in the design, research and application of Internet of things based on the scientific principle and scientific methods, including design experiment, analysis and interpretation data, and get reasonable and effective conclusion through information synthesis.	4-1. Be able to select research routes based on professional theory and characteristics of engineering objects.
	4-2. Be able to design experimental schemes, carry out experiments, analyze and interpret data for complex engineering problems of data acquisition, integration and application systems in the Internet of things engineering and related fields based on scientific principles and scientific methods .
	4-3. Be able to carry out application research on complex engineering problems related to the Internet of things, and get reasonable and effective conclusions through information synthesis.
<b>Requirement 5:</b> Using modern tools: be able to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for engineering practice, including data collection, analysis and prediction of complex engineering problems, and understand their limitations.	5-1. Master the basic methods of literature retrieval, data inquiry and the use of modern information technology to obtain relevant information.
	5-2. Be able to correctly develop, select and use simulation tools, human-machine interface integration tools and other technologies and resources to predict and analyze complex engineering problems related to the Internet of things.
	5-3. In the practice of solving complex engineering problems related to the Internet of things, improve the application ability of modern tools, and be able to understand their limitations.

<p>Requirement 6: Engineering and society: be able to conduct reasonable analysis based on the relevant background knowledge in the field of Internet of things engineering, evaluate the impact of engineering practice on social, health, safety, legal and cultural issues, and understand the responsibilities to be undertaken.</p>	6-1. Master the relevant knowledge of society, health, safety, law and culture, and be able to make reasonable analysis based on the background knowledge of Internet of Things Engineering.
	6-2. Personally experience and evaluate the impact of engineering practice and scheme on society, health, safety, law and culture, and understand the responsibilities in the engineering practice of Internet of things.
	6-3. According to the relevant knowledge of society, health, safety, law and culture to design complex engineering problems to meet the relevant requirements
<p>Requirement 7: Environment and sustainable development: be able to understand and evaluate the impact of IOT related products and systems on environment and social sustainable development, and be able to build and implement projects with both environmental protection and green production efficiency.</p>	7-1. Understand and experience the impact of engineering practice of IOT relevant complex engineering problems on the sustainable development of environment and society.
	7-2. Analyze and evaluate the impact of engineering practice on the sustainable development of environment and society by using relevant laws and regulations such as environment and sustainable development.
	7-3. In the design, research and development ,comprehensive application of Internet of things projects, meeting the requirements of environmental protection and green production
<p>Requirement 8: Professional norms: have humanities and social science literacy, sense of social responsibility, be able to understand and abide by engineering professional ethics and norms in engineering practice, and fulfill responsibilities.</p>	8-1. Cultivate a good world outlook and outlook on life, and understand national and social development.
	8-2. establish and practice the socialist core values, understand the relationship between individuals and society, understand China's national conditions, and clarify the responsibilities and missions of individuals as builders of the socialist cause.
	8-3. Understand the professional nature and responsibilities of engineers. Abide by the engineering professional ethics and norms, and fulfill the responsibility.in the Internet of things engineering practice,
<p>Requirement 9: Individual and team: have good organization and team cooperation ability, and be able to take on the role of individual, team member and person in charge under the multi-disciplinary background.</p>	9-1. Be able to play an individual role in a multidisciplinary team and give full play to individual advantages.
	9-2. Be able to play the role of team member with team spirit in a multidisciplinary team.
	9-3. Be able to play the role of team leader with management ability in a multidisciplinary team.
<p>Requirement 10: Communication: be able to effectively communicate with peers in the industry and the public on complex engineering issues related to the Internet of things engineering, including writing reports and design manuscripts, making statements,</p>	10-1. Have the ability of foreign language communication and a certain international vision, be able to communicate and exchange in the cross-cultural background.
	10-2. Be able to skillfully read professional foreign language literature, and effectively communicate by oral and writing with peers in the industry and the public on complex engineering issues related to the Internet of things.

clearly expressing or responding to instructions, and have a certain international vision to communicate and exchange in a cross-cultural context.	10-3. Be able to use the professional knowledge to write IOT engineering report, express their views clearly, accept and understand the views of peers in the industry and the public.
Requirement 11: Project management: be able to understand and master the methods of project management and economic decision-making, and be able to apply them in multidisciplinary engineering practice.	11-1. Understand and master certain engineering management principles and economic decision-making methods.
	11-2. Be able to effectively analyze and comprehensively evaluate the complex IOT engineering problems by applying the engineering management principles and economic decision-making methods.
	11-3. Using the method of economic decision-making, to design the IOT project meeting the requirements
Requirement 12: Lifelong learning: it can adapt to the needs of social development and individual development, has the consciousness of autonomous learning and lifelong learning, and has the ability of continuous learning, continuous learning and adapting to development.	12-1. Master the language tools or computer tools of lifelong learning, have the ability of autonomous learning, and be able to obtain the knowledge and methods to solve problems through independent access to information.
	12-2. Fully aware of the rapid development of the Internet of things engineering related engineering fields and the importance of self-learning and lifelong learning, with good psychological and physical fitness to adapt to various tasks in the work.
	12-3. Learn and use the new technology related to the Internet of things, to solve the problems of the Internet of things.

### The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives			
	Traning Objectives 1	Traning Objectives 2	Traning Objectives 3	Traning Objectives 4
1: Engineering Knowledge	√			√
2: Problem Analysis	√	√		
3: Design/Development Solutions	√	√		
4: Research		√		√
5: Use Modern Tools		√		√
6: Engineering and Society		√	√	
7: Environment and Sustainable Development			√	
8: Career Planning			√	
9: Individuals and Teams			√	
10: Communicate			√	√
11: Project Management			√	
12: Lifelong Learning			√	√

#### **IV. Major Subject**

Information acquisition and Internet of things Engineering

#### **V. Core Courses**

Information Recognition and Processing, Integration Class, Circuit and Electronics Class, Computer Technology Class, Network and Communication Technology Class.

#### **VI. Duration**

The duration of undergraduate program is 4 years and the flexible duration is 3-6 years according to the credit system management.

#### **VII. Confer Degrees**

Students should obtain at least 166 credits before graduation. The Bachelor of engineering degree can be granted to those who meet the degree awarding requirements of the relevant regulations on the awarding of bachelor's degree for graduates of Shenyang University of Chemical Technology (revised in March 2017).

## VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit Requirement	Subtotal	Proportion (%)
General Education	Compulsory Course	Ideological and Political Education	Compulsory	17	41.5	25.0
		Foreign Languages		12		
		Computer		2.5		
		Military Security		2		
		Labor Sports		5		
		Innovation and Entrepreneurship		2		
		Mental Health		1		
	Elective Subjects	Aesthetic Education (400)	Elective	2	8	4.8
		China and the World (500)		2		
		Four Histories (600)		1		
		Economic Management (700)		1		
Traditional Culture (900)		2				
Practice Course	Military Training	Practice	2	2	1.2	
Discipline Education	Basic Subject Courses	Public Basic Class	Compulsory	61.5	73	69.0
		Professional Foundation				
	Subject Practice course	-	Practice	11.5		
Specialized Education	Professional Core Courses	-	Compulsory	11.5	37.5	
	Professional Elective Courses	-	Elective	4		
	Professional Practice Courses	-	Practice	22		
Competency Development	Professional Characteristic Courses	-	Compulsory (or Practice)	4	4	
Extracurricular Practice	Extracurricular General Knowledge Practice	Humanistic Social Practice	Extracurricular Practice	4		
		Physical and Mental Health Practice				
		Foreign Language Skills Practice				
	Innovation and Entrepreneurship Practice	Innovation Training		4		
		Innovation Competition				
		Maker Activities				
Career Education	Growth Planning		1			
Total Credits / Proportion					166	100%

九、物联网工程专业教学进程表

Table of Teaching Schedule for IoT Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八			
											1st	2nd	3rd	4th	5th	6th	7th	8th			
通识教育课 General Education	必修 Compulsory	思政类 Ideological and Political Courses	0710093001	思想道德与法治 Ideological Morality and the Rule of Law	3.0	48	32			16		2									
			0710053001	中国近现代史纲要 Outline of Chinese Contemporary and Modern History	3.0	48	32			16	2										
			0710103001	马克思主义基本原理* Basic Principles of Marxism*	3.0	48	32			16				2							
			0710133001	毛泽东思想和中国特色社会主义理论体系概论* Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3.0	48	32			16				2							
			0710123001	习近平新时代中国特色社会主义思想概论 Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8					3						
			0710012301	形势与政策 Current Situation and Policies	2.0	64	64				2	2	2	2	2	2	2	2	2		
			外语类 Foreign Language Courses	0211003101	大学外语I College English I	3.0	48	48				3									
				0211003201	大学外语II* College English II*	3.0	48	48					3								
				0241003301	大学外语III College English III	3.0	48	48						3							
					大学外语III(进阶英语) College English III(Advanced English CET6-Orientated)	3.0	48	48							3						



课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
通识教育课 General Education	必修 Compulsory	Courses	1510261302	安全教育   Safety Education	1.0	16					1	1	1	1	1	1	1			
		劳动体育类 Labor and Sport Education	2640021001	劳动教育   Labour Education	1.0	16	16						2							
			0410011101	大学体育I   College Physical Education I	1.0	36		36				2								
			0410021201	大学体育II   College Physical Education II	1.0	36		36					2							
			0410031301	大学体育III   College Physical Education III	1.0	36		36						2						
			0410041401	大学体育IV   College Physical EducationIV	1.0	36		36							2					
			创新创业类 Innovation and Entrepreneurship courses	1557011002	创造性思维与创新方法   Creative Thinking and Innovative Methods	1.0	16	16							2					
		1740011001		创业基础   Entrepreneurial Foundation	1.0	16	16								2					
		心理健康类 Mental Health Courses	0510041001	大学生心理与健康教育   Mental and Health Education for College Students	1.0	16	16					2								
		小计 Subtotal					41.5	780	576	144	12	64	11.0	15.0	11.0	13.0	4.0	2.0	2.0	1.0
选修		包括 5 个模块，分别是经济管理类（1.0）、美育类（2.0）、四史（1.0）、传统文化（2.0）、中国与世界（2.0），每学期最多选修 2 门课程。It includes five modules,																		



课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
						讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八		
										1st	2nd	3rd	4th	5th	6th	7th	8th		
通识教育课 General Education	Optional	namely, economic management (1 credit), aesthetic education (2 credits), four history (1 credit), traditional culture (2 credits), China and the world (2 credits), and a maximum of 2 courses per semester.																	
		小计 Subtotal		8.0															
	实践 Practice	0415102011	军训   military training	2.0	48				48	+2								集中	
	合计 Total				2.0														
学科平台课 Discipline Education	必修 Compulsory	数学与自然科学类 Natural Science & Mathematics	0310004101	高等数学 I*   Advanced Mathematics I*	4.5	80	72			8	6								
			0310005201	高等数学 II*   Advanced Mathematics II*	5.5	96	88			8	6								
			0310032001	线性代数    Linear Algebra	2.0	32	32					3							
			0310042001	概率论与数理统计   Probability and Statistics	2.0	32	32							2					
			0310063101	大学物理 I*   University Physics I*	3.0	48	46	2					3						
			0310063201	大学物理 II*   University Physics II*	3.0	48	46	2						3					
			1510251002	复变函数 Function of Complex Variable	1.5	24	24						2						
		工程基础类 Foundation Engineering	1510163002	电路分析基础*    Fundamentals of Circuit Analysis*	3.5	56	56						4						
			1510913002	模拟电子技术*    Analog Electronic Technology*	3.5	60	48	12						3					
			1510923002	数字电子技术*   Digital Electronic Technology*	3.5	60	48	12							3				

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
学科平台课 Discipline Education	必修 Compulsory	工程基础类 Foundation Engineering	1510141002	电气工程制图及 CAD   Electrial Engineering Drawing and CAD	1.5	26	20		6			2								
		专业基础类 Subject Foundation Requisite	1518811002	物联网工程专业概论   Introduction to Internet of Things Engineering	1	16	16				2									
			1514822002	电磁场与电磁波   Electromagnetic Field and Wave	2	32	32						2							
			1514883002	信号与系统I*   Signal and SystemI*	3	50	44	6					3							
			1517122002	通信原理I*   Principles of Communications*	2.5	42	36	6							3					
			1514892002	数字信号处理*    Digital Signal Processing	2.5	42	36	6						3						
			1514922002	数据库原理与应用    Principle and Application of Database	2	36	24		12							3				
			1513272002	算法与数据结构   Algorithm and Data Structure	2.5	44	32		12					3						
			1514902002	高频电子与通信电路*   High Frequency Electronics and Communication Circuit*	2.5	42	36	6										3		
			1517032002	计算机网络*    Computer Network*	2.5	44	32		12									2		
			1514832002	信息论与编码    Information Theory and Coding	2	32	32											2		
			1513822002	单片机原理与应用   Principle and Application of MCU	2.5	44	32	12								3				
			1514962002	现代检测技术及系统   Modern Detection Technology and System	2.0	34	28	6										2		



课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八			
										1st	2nd	3rd	4th	5th	6th	7th	8th			
专业教育课 Specialized Education	必修 Compulsory	1524932002	面向对象程序设计    Object Oriented Programming	2	36	24		12					3							
		1526982002	计算机组成原理*    Principles of Computer Organization *	2.5	42	36	6							3						
		1514662002	化工过程信息处理与传输   Chemical Process Information Processing Transmission	2.0	32	32								2						
		1528722002	传感器原理与应用   Principle and Application of Sensor	2.5	42	36	6									3				
		1528732002	RFID 射频识别技术   RFID Technology	2.5	44	32	12										3			
		小计 Subtotal			11.5	200	152	36	12											
	选修 Optional	1537242002	Matlab 程序设计   Matlab Programming	2	36	24		12				2								
		1534842002	Python 数据分析与应用   Python Data Analysis and Application	2	36	24		12					2							
		1531552002	自动控制原理II    Principle of Automatic Control II	2	34	28	6						2							
		1534962002	C#程序设计   C program design	2	36	24		12						2						
		1534863002	大数据原理与技术   Principle and technology of big data	3	56	32		24								4				
		1538563002	ZigBee 技术应用及无线传感器网络   ZigBee technology and wireless sensor networks	3	52	40	12							3						
		1534872002	语音信息处理   Speech Signal Processing	2	36	24		12							2					

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes			
						讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八				
										1st	2nd	3rd	4th	5th	6th	7th	8th				
专业教育课 Specialized Education	选修 Optional	1538642002	信息安全基础    Fundamentals of Information Security	2	36	24	12							2							
		1537073002	移动通信    Mobile Communication	3	52	40	12									3					
		小计 Subtotal		4.0	374	260	42	72													
	(修读要求 4.0 学分)																				
	实践 Practice	1518351032	工程认识实习    Engineering Cognition Practice	1	24		24					2									
		1514522022	信号处理课程设计   Course Design of Signal Processing	2	48		38											+1	集中		
		1514531022	程序实践    Procedure Practice	1	24		24							2						分散	
		1518692022	物联网工程实践    Engineering Practice of Internet of things	2	48		48												+2	集中	
		1514562022	信息集成综合实践    Comprehensive practice of information integration	2	48		2												+2	集中	
		1518811042	毕业设计(论文)    Graduation Design (Thesis)	14	336															+14	
		小计 Subtotal		22	420																
	合计 Total																				
	能力拓展课 Competency Development	必修或实践 Compulsory or Practice	1527802002	现代通信与信息技术    Modern communication and information technology	2	34	28	6										2			
1529972002			嵌入式系统原理    Embedded system Principle	2	36	24	12											2			
小计 Subtotal			4	70	52	18															
(修读要求 Fill in the Study Requirements) 4.0																					

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
总计 Sum					167															
课外环节 Extracurricular practice	课外实践 Extracurricular practice	人文社会实践 Culture and Society Practice	1513401032	社会调查   Social Survey	0.5	12											0.5	分散		
		身心健康社会实践 Mentally and Physically Practice	0410050751	课外体育锻炼   Extracurricular Physical Exercise	0.5	12												0.5	分散	
			2640030011	劳动教育实践   Labour Education Practice	0.5	12					0.5								分散	
			0510070311	心理健康辅导   Mental Health Counseling	0.5	12												0.5	分散	
		外语技能实践类 Foreign Language Proficiency Training Practice	0210010011	外语技能实践（初级）   Foreign Language Proficiency Training Practice (elementary)	2.0	48								2						二选 一
			0210020011	外语技能实践（高级）   Foreign Language Proficiency Training Practice (advanced)	2.0	48								2						
		能力与创新实践 Capability and Innovation Practice	1511712022	大学生素质拓展与创新实践   Quality Development and Innovation Practice	4.0	96														1~8 学期依据《沈阳化工大学创新创业实践学分认定办法》由创新创业学院认定
		成长规划类 Growth Planning Courses	1510271312	职业规划与就业指导   Career Planning and Employment Guidance	1.0	40	40							1					1	
小计 Subtotal																				

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5,课程名称中画\*为考试课。

Note: "Cre. (Credits)", "T.C.H. (Total Credit Hours)", "Lec. (Lecture)", "Exp. (Experiment)", "Pro. (Programming)", "Pra. (Practice)".

## 十、物联网专业学士学位课程一览表 A list of bachelor's degree programs in IoT

课程类别 Course Type	模块名称 Modules	序号 No.	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester	
通识教育课 General Education	政治理论 Political Theory	1	0710103001	马克思主义基本原理* Elementary Theory of Marxism*	3	3	
		2	0710133001	毛泽东思想和中国特色社会主义理论体系概论* Mao Zedong Thought and Theory of Socialism with Chinese Characteristics *	3	4	
学科平台课 Discipline Education	数学 Mathematics	3	0310014101	高等数学I* Advanced Mathematics I*	5	1	
	物理 Physics	4	0310063101	大学物理I* University Physics I*	3	2	
	工程基础 Engineering Foundation	5	1510163002	电路分析基础* Fundamentals of Circuit Analysis*	3.5	2	
		6	1510223002	数字电子技术* Digital Electronic Technology*	3.5	4	
	专业基础 Subject Foundation Requisite	7	1514882002	信号与系统I* Signal and SystemI*	2.5	3	
		8	1513272002	算法与数据结构* Algorithm and Data Structure*	2.5	3	
		9	1515751002	电子信息类专业外语 Specialized English on Telecommunication	1	5	
		10	1517122002	通信原理I* Principles of Communications*	2.5	5	
		11	1514892002	数字信号处理* Digital Signal Processing*	2.5	4	
		12	1513822002	单片机原理与应用   Principle and Application of MCU	2.5	5	
	专业教育课 Specialized Education	物联网工程类 IOT	13	1526982002	计算机组成原理* Principles of Computer Organization *	2.5	4
			14	1528722002	传感器原理与应用 Principle and Application of Sensor	2.5	5
15			1528732002	RFID 射频识别技术 RFID Technology	2.5	5	

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》

### 十一、全学程实践环节周历安排 Weekly Calendar of all Practice Sessions

学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注
一		☆	☆															::	::	·		
二													※					::	::	·	·	
三																		::	::	·		
四															P	P		::	::	·	·	
五				P	P													::	::	·		
六																△		::	::	·	·	
七	△	△	△	/	/	△												::	::	·		
八	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=					

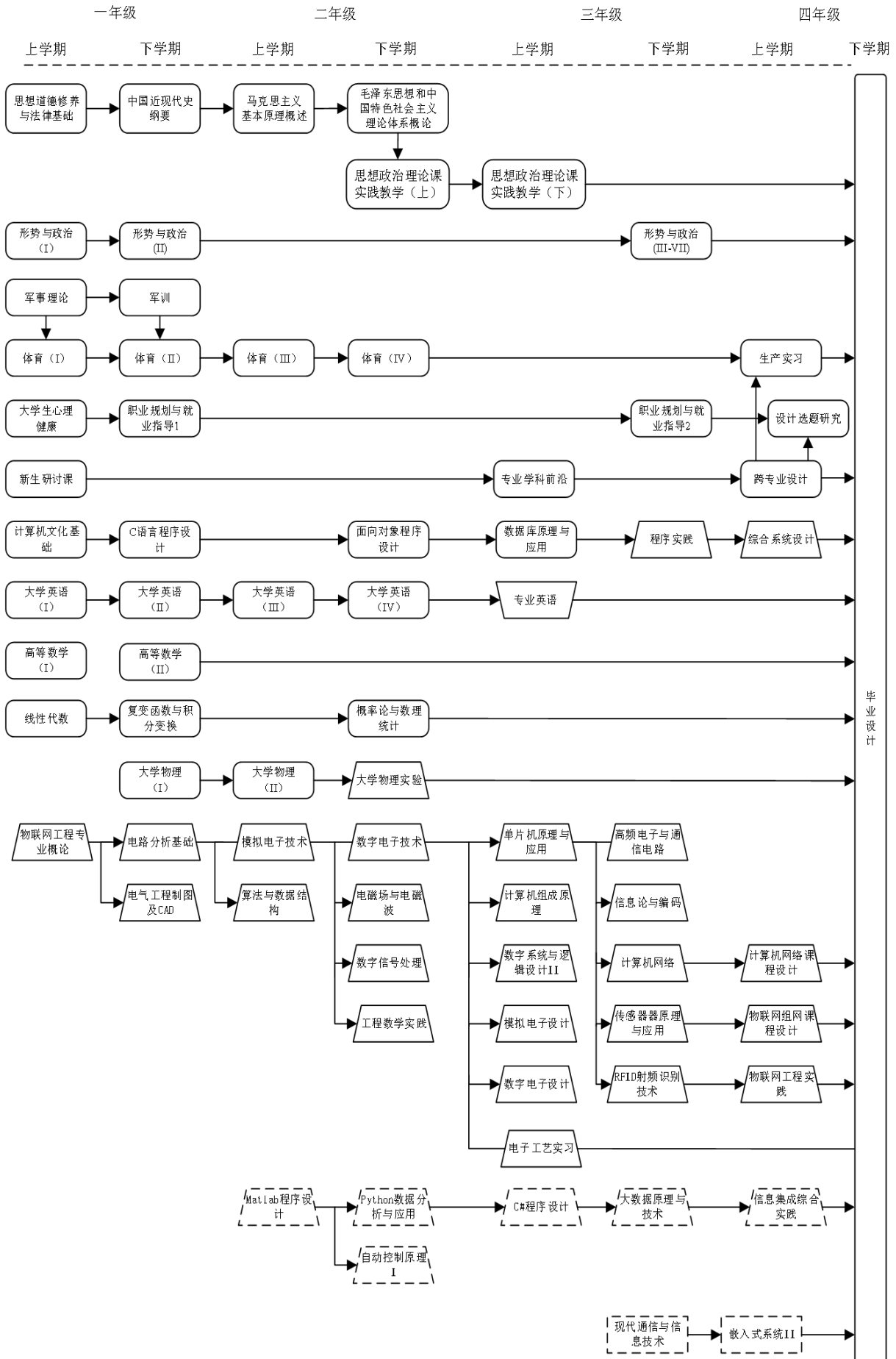
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符号说明(Symbol Description):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P 各类实训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼ 认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计(论文)||Graduation Project(Thesis)    ·小学期||Primary Term



## 十二、课程体系配置图 Curriculum System Configuration Diagram



十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements (High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																													
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	6.1	6.2	7.1	7.2	8.1	8.2	9.1	9.2	10.1	10.2	11.1	11.2	12.1	12.2	
马克思主义基本原理概论*   Basic Principles of Marxism*																				H										
中国近现代史纲要   Outline of Chinese Contemporary and Modern History																				M										
思想道德修养与法律基础   Ideological Morality and the Rule of Law																					H									
毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*																				M										
形势与政策   Current Situation and Policies										H						M		H											L	
习近平新时代中国特色社会主义思想概论    Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																								M						
大学体育   College Physical Education																				L		L								
大学外语   College English																									H					
高等数学*   Advanced Mathematics*	H																													
线性代数   Linear Algebra	M				L																									







课程 (Courses)	毕业能力要求 (Graduation Requirements)																												
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	6.1	6.2	7.1	7.2	8.1	8.2	9.1	9.2	10.1	10.2	11.1	11.2	12.1	12.2
电子工艺实习   Electronic Craft Practice																		M	H										
工程认识实习   Engineering Cognition Practice																L				L			L						
生产实习   Production Practice																	M		H		M								
金工实习   Metalworking Practice																	L												
计算机网络课程设计   Computer Network Course Design									M					L															
毕业设计 (论文)   Graduation Design (Thesis)							H	H		M			H											M	L		M		
物联网工程实践   Engineering Practice of Internet of things				M								H	H		H														
程序实践   Procedure Practice									M			H																	
综合系统设计   Integrated System Design							L	M			H												H						H
信息集成实训综合实践   Comprehensive practice of information integration				H				M														H							
嵌入式系统原理    Embedded system Principle			M			M						L			L														
电子线路 CAD 设计实践    CAD Design Practice of Electronic Circuit	M											L																	







# 沈阳化工大学专升本培养方案

## 信息工程学院

专业名称：电气工程及其自动化

专业代码：080601

制 定：蔡庆春

审 核：孔晓光

审 定：于三三

批 准：金志浩

2021年8月

# 电气工程及其自动化专业（专升本）培养方案

## 一、培养目标

本专业培养具有社会责任感，适应国家和区域经济发展要求，德智体美劳全面发展的社会主义接班人，能够在装备制造等领域从事电气控制相关的科学研究、工程设计、技术开发和项目管理等工作的高素质应用型工程技术人才。

毕业 5 年后的学生：

(1) 具有扎实的理论基础，具备适应装备制造等领域发展的专业能力和专业视野，能够综合运用数学、自然科学、专业知识以及交叉学科知识，对电气工程及相关领域复杂工程问题的解决方案进行分析和设计。

(2) 具有在企业与社会环境下，运用现代工具对装备制造业及相关领域的电气控制系统进行分析、设计、集成和服务的能力。

(3) 具有高度的社会责任感和道德修养、健全的人格、良好的心理素质和人文科学素养、和谐包容的团队精神、有效的沟通与表达能力和工程项目管理能力，在工程实践中能综合考虑法律、环境与可持续性发展等因素，具有坚持公众利益优先的素质。

(4) 具有广阔的国际视野，主动适应不断变化的国内外形势和环境，能够通过多种学习渠道更新知识，形成终生学习的习惯，实现能力和技术水平的提升。

## 二、专业方向

电气控制

## 三、毕业要求

本方案根据本科专业类教学质量国家标准、专业认证标准中的要求，基于成果导向教育理念，依据人才培养目标和专业多年形成的人才培养特色，针对电气工程领域及电气工程及其自动化专业的特点，制定本专业毕业能力要求和指标点分解。

毕业能力要求及其指标点分解：

毕业能力要求	指标点
毕业要求 1：工程知识：掌握数学、自然科学、工程基础和电气专业知识，能够运用其理论和方法解决装备制造业及相关工程领域电气控制系统的复杂工程问题。	1-1. 能够将数学、自然科学、工程基础和专业知识运用到复杂工程问题的恰当表述中。
	1-2. 能够将工程基础知识应用于电气控制单元的设计和分析。
	1-3. 能够将工程基础和专业知识用于装备制造业及相关工程领域电气控制系统判别和分析。
	1-4. 能够将工程基础和专业知识用于装备制造业及相关工程领域电气控制系统设计和改进。
毕业要求 2：问题分析：能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究来分析装备制造业及相关工程领域电气控制系统的复杂工程问题，以获得有效结论。	2-1. 能够运用数学、自然科学和工程科学的基本原理，识别装备制造业及相关工程领域电气控制系统复杂工程问题中的关键环节。
	2-2. 能够通过系统集成分析、基于设备运行操作指标分析等方法正确表达装备制造业及相关工程领域电气控制系统的复杂工程问题。
	2-3. 能够通过文献研究来分析装备制造业及相关工程领域电气控制系统的复杂工程

	问题, 以获得有效结论。
毕业要求 3: 设计/开发解决方案: 在综合考虑社会、健康、安全、法律、文化以及环境等因素的前提下, 能够针对装备制造业及相关工程领域电气控制系统的复杂工程问题设计解决方案, 设计满足特定需求的系统、单元(部件), 并能够在设计环节中体现创新意识。	3-1. 能够在综合考虑社会、健康、安全、法律、文化以及环境等现实约束条件下, 对装备制造业及相关工程领域电气控制系统的复杂工程问题设计解决方案。 3-2. 能够根据用户的特定需求, 设计合理的电气控制系统、单元。 3-3. 能够通过集成单元过程对电气控制设计方案进行优化, 体现创新意识。
毕业要求 4: 研究: 能够基于科学原理并采用科学方法对装备制造业及相关工程领域电气控制系统的复杂工程问题进行研究, 包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。	4-1. 能够基于专业理论, 根据对象特性, 选择研究路线。 4-2. 能够基于科学原理并采用科学方法对装备制造业及相关工程领域电气控制相关的复杂工程问题设计实验方案, 开展实验, 分析与解释数据。 4-3. 能够针对装备制造业及相关工程领域电气控制相关的复杂工程问题进行控制系统应用研究, 并通过信息综合得到合理有效的结论。
毕业要求 5: 使用现代工具: 掌握文献检索、资料查询以及运用现代信息技术获取相关信息的基本方法, 能够针对装备制造业及相关工程领域电气控制系统的复杂工程问题, 开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具, 包括对复杂工程问题的预测与模拟, 并能够理解其局限性。	5-1. 掌握文献检索、资料查询以及运用现代信息技术获取相关信息的基本方法。 5-2. 能够正确选择与使用仿真工具、人机界面集成工具等技术、资源, 对装备制造业及其相关的复杂工程问题进行预测与模拟。 5-3. 在解决电气控制相关的复杂工程问题实践中提高现代工具的应用能力, 并能够理解其局限性。
毕业要求 6: 工程与社会: 能够基于电气控制相关的背景知识进行合理分析, 评价专业工程实践和复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响, 并理解应承担的责任。	6-1. 掌握社会、健康、安全、法律以及文化等方面的相关知识, 能够基于装备制造业及相关工程领域电气控制系统的背景知识进行合理分析。 6-2. 掌握社会主义核心价值观的内涵和意义, 在正确价值观的指导下, 能够评价工程实践和工程方案对社会、健康、安全、法律以及文化的影响, 理解在装备制造业及相关工程领域电气控制系统相关工程实践和复杂工程问题解决方案中应承担的责任。
毕业要求 7: 环境和可持续发展: 能够理解和评价针对装备制造业及相关工程领域电气控制系统的复杂工程问题的工程实践对环境、社会可持续发展的影响。	7-1. 能够理解和体验针对电气控制相关的复杂工程问题的工程实践对环境、社会可持续发展的影响。 7-2. 能够运用环境与可持续发展等相关法律法规分析、评价针对电气控制相关的复杂工程问题的工程实践对环境、社会可持续发展的影响。
毕业要求 8: 职业规范: 具有人文社会科学素养、社会责任感, 能够在装备制造业及相关工程领域电气控制系统的工程实践中理解并遵守工程职业道德和规范, 履行责任。	8-1. 具备科学的的世界观、人生观和价值观, 理解个人与社会的关系, 了解中国国情。 8-2. 能在工程实践中自觉遵守工程职业道德和规范, 诚实公正、诚信守则、爱岗敬业、敬爱生命。 8-3. 能够在工程实践中自觉履行对公众安全、健康、福祉和环境保护的社会责任。
毕业要求 9: 个人和团队: 能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。	9-1. 理解团队合作的意义, 能够在工程项目的研发和实施过程中, 与不同学科领域人员进行有效沟通, 合作共事。 9-2. 具有良好的大局观念, 能够在团队中根据需要独立或合作开展工作。 9-3. 能够在多学科交叉背景下, 组织、协调和带领团队开展工作。
毕业要求 10: 沟通: 能够就装备制造业及相关工程领域电气控制系统的复杂工程问题与业界同行及社会公众进行有效沟通和交流, 包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令, 并具备一定的国际视野, 能够在跨文化背景下进行沟通和交流。	10-1. 能够运用语言工具准确表达自己的观点, 能与业界同行和公众进行有效沟通和交流。 10-2. 了解装备制造业及相关工程专业领域国际发展趋势和热点问题。 10-3. 理解并尊重文化差异, 能够就电气控制相关的复杂工程问题, 在跨文化背景下进行基本的沟通和交流。
毕业要求 11:	11-1. 理解并掌握一定的工程管理原理与经济决策方法。

项目管理：理解并掌握工程管理原理与经济决策方法，并能在多学科环境中应用。	11-2. 能够应用工程管理原理与经济决策方法对电气控制相关的复杂工程问题进行有效分析和综合评价。
毕业要求 12： 终身学习：具有自主学习和终身学习的意识，有不断学习和适应发展的能力。	12-1. 能在社会发展的大背景下，认识到不断探索和学习的必要性，具有自主学习和终身学习的意识。
	12-2. 具有自主学习能力，包括对问题的理解能力，归纳能力和提出问题能力等；掌握终身学习的语言工具和计算机工具，身心健康，以适应工作中的各种任务。

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。

### 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标			
	培养目标 1	培养目标 2	培养目标 3	培养目标 4
1: 工程知识	√			
2: 问题分析	√			
3: 设计/开发解决方案	√			
4: 研究		√		
5: 使用现代工具		√		
6: 工程与社会		√		
7: 环境和可持续发展			√	√
8: 职业规范			√	
9: 个人和团队			√	
10: 沟通			√	√
11: 项目管理			√	
12: 终身学习				√

#### 四、主干学科

电气工程

#### 五、专业核心课程

电路分析基础、模拟电子技术、数字电子技术、电机及拖动基础、自动控制原理、电力系统分析基础、电力电子技术、电气控制技术、运动控制系统。

#### 六、修业年限

本科基本学制 2 年，按照学分管理制度管理。

#### 七、授予学位

学生应至少修满 91.0 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者，可授予工学学士学位。

## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例(%)
通识教育课	通识教育必修课	思政类	必修	10	23.5	25.82
		外语类		6		
		计算机类		2.5		
		军事安全类		2		
		劳动教育类		1		
		创新创业类		1		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	1	5	5.49
		中国与世界(500)		1-3		
		四史(600)		1		
		经济管理类(700)		1		
		传统文化(900)		1		
	通识教育实践课	军训	实践	2	2	2.00
学科平台课	学科基础课程	公共基础类	必修	26.5	27.0	29.67
		专业基础类				
	学科实践课程	-	实践	0.5		
专业教育课	专业核心课程	-	必修	10.5	33.5	36.81
	专业选修课程	-	选修	2		
	专业实践课程	-	实践	21		
课外环节	课外通识实践	人文社会实践	课外实践	4		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
	生涯教育	成长规划类		1		
总学分/比例					91.0	100

# Electrical Engineering and Automation Major 2021 Undergraduate Education Program

## I. Educational Objectives

### 1. Educational Objectives

This major cultivates high-quality application-oriented engineering and technical personnel who have a sense of social responsibility, adapt to the requirements of national and regional economic development, develop morally, intellectually, physically, aesthetically and laboriously, and can engage in scientific research, engineering design, technical development and project management related to electrical control in the field of equipment manufacturing.

Graduates should obtain knowledge and competence as follows:

- (1) With solid theoretical foundation, professional ability and vision to adapt to the development of equipment manufacturing and other fields, they are able to use mathematics, natural science, professional knowledge and interdisciplinary knowledge to analyze and design solutions to complex engineering problems in electrical engineering and related fields.
- (2) Be able to analyze, design, integrate and serve systems with the enterprise and social environment, the use of modern tools for equipment manufacturing and related fields of electrical control
- (3) In engineering practice, they can comprehensively consider the factors of law, environment and sustainable development, and have the quality of adhering to the priority of public interest. with a high sense of social responsibility and moral cultivation, sound personality, good psychological quality and humanity.
- (4) With a broad international perspective, they can actively adapt to the changing domestic and international situations and environment, can update knowledge through a variety of learning channels, form lifelong learning habits, and achieve the improvement of ability and technical level.

## II. Major direction

Electrical control

## III. Graduation Requirements

According to the requirements of the national standards of undergraduate professional teaching quality and professional certification standards, based on the concept of achievement oriented education, according to the talent training objectives and professional training characteristics formed over the years, and in view of the characteristics of the field of electrical engineering and electrical engineering and automation specialty, the graduation ability requirements and index points of this specialty are formulated.

Graduates should obtain knowledge and competences as follows:

Graduation Requirements	Indices
Requirement 1: Engineering knowledge: Master	1-1. Be able to apply mathematics, natural science, engineering foundation and professional knowledge to the proper expression of complex engineering problems.

<p>mathematics, natural science, engineering foundation and electrical professional knowledge, and be able to use their theories and methods to solve complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields.</p>	1-2. Be able to apply basic engineering knowledge to the design and analysis of electrical control unit.
	1-3. Be able to apply engineering foundation and professional knowledge to the identification and analysis of electrical control system in equipment manufacturing industry and related engineering fields.
	1-4. Be able to apply basic and professional engineering professional knowledge to designing and improving electrical control system in equipment manufacturing industry and related engineering fields.
<p><b>Requirement 2:</b>  <b>Problem analysis:</b>          Be able to apply the basic principles of mathematics, natural science and engineering science to identify, express and analyze the complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields through literature research, so as to obtain effective conclusions.</p>	2-1. Be able to use the basic principles of mathematics, natural science and engineering science to identify the key links in complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields.
	2-2. Be able to express the complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields through system integration analysis and equipment operation index analysis.
	2-3. Through literature research, they can analyze the complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields and obtain effective conclusions.
<p><b>Requirement 3:</b>  <b>Design / development solutions:</b> under the premise of comprehensive consideration of social, health, safety, legal, cultural and environmental factors, we can design solutions for complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields, design systems, units (components) to meet specific needs, and embody the sense of innovation in the design process.</p>	3-1. Be able to design solutions to complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields under the realistic constraints of society, health, safety, law, culture and environment.
	3-2. Be able to design reasonable electrical control system and unit according to the specific needs of users.
	3-3. Be able to optimize the electrical control design scheme through the integrated unit process, reflecting the innovation consciousness.
<p><b>Requirement 4:</b>  <b>Research:</b>          Based on scientific principles and using scientific methods, students can study complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields, including designing experiments, analyzing and interpreting data, and obtaining reasonable and effective conclusions through information synthesis.</p>	4-1. Be able to choose research route based on professional theory and object characteristics.
	4-2. Be able to design experimental schemes, they carry out experiments, analyze and interpret data for complex engineering problems related to electrical control in equipment manufacturing industry and related engineering fields based on scientific principles and scientific methods.
	4-3. Be able to carry out control system application research on complex engineering problems related to electrical control in equipment manufacturing industry and related engineering fields, and obtain reasonable and effective conclusions through information synthesis.

<p>Requirement 5:</p> <p>Using modern tools: master the basic methods of literature retrieval, data query and use modern information technology to obtain relevant information, and be able to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools, including the understanding of complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields and prediction and simulation, and be able to understand its limitations.</p>	<p>5-1. Master the basic methods of literature retrieval, data inquiry and the use of modern information technology to obtain relevant information.</p>
	<p>5-2. Be able to select and use simulation tools, human-computer interface integration tools and other technologies and resources to predict and simulate the equipment manufacturing industry and its related complex engineering problems.</p>
	<p>5-3. In the practice of solving complex engineering problems related to electrical control, they can improve the application ability of modern tools, and be able to understand their limitations.</p>
<p>Requirement 6:</p> <p>Engineering and society: be able to conduct reasonable analysis based on the background knowledge related to electrical control, evaluate the impact of professional engineering practice and complex engineering problem solutions on society, health, safety, law and culture, and understand the responsibilities.</p>	<p>6-1. Master the relevant knowledge of society, health, safety, law and culture, and be able to make reasonable analysis based on the background knowledge of electrical control system in equipment manufacturing industry and related engineering fields.</p>
	<p>6-2. Grasp the connotation and significance of socialist core values, and under the guidance of correct values, be able to evaluate the impact of engineering practice and engineering scheme on society, health, safety, law and culture, and understand the responsibilities to be undertaken in the engineering practice related to electrical control system and solutions to complex engineering problems in equipment manufacturing industry and related engineering fields.</p>
<p>Requirement 7:</p> <p>Environment and sustainable development: Be able to understand and evaluate the impact of engineering practice aiming at complex engineering problems of electrical control system in equipment manufacturing industry and related engineering fields on environment and social sustainable development</p>	<p>7-1. Be able to understand and experience the impact of engineering practice for complex engineering problems related to electrical control on environmental and social sustainable development.</p>
	<p>7-2. Be able to use environmental and sustainable development laws and regulations to analyze and evaluate the impact of engineering practice for complex engineering problems related to electrical control on environmental and social sustainable development.</p>
<p>Requirement 8:</p> <p>Professional norms:</p> <p>Have the quality of Humanities and Social Sciences, sense of social responsibility, be able to understand and abide by the engineering professional ethics and norms in the engineering practice of electrical control system in equipment manufacturing industry and related engineering fields, and fulfill the responsibilities.</p>	<p>8-1 Have a scientific world outlook, outlook on life and values, understand the relationship between individual and society, and understand China's national conditions.</p>
	<p>8-2. Be able to consciously abide by engineering professional ethics and norms in engineering practice, be honest and fair, code of integrity, love their posts and respect their lives.</p>
	<p>8-3. Be able to consciously fulfill the social responsibility for public safety, health, well-being and environmental protection in engineering practice.</p>



<p>Requirement 9: Individual and team: Be able to play the role of individual, team member and leader in a multidisciplinary team.</p>	9-1. Understand the significance of teamwork, and be able to effectively communicate and cooperate with personnel in different disciplines in the R & D and implementation of engineering projects.
	9-2. Have a good overall concept and be able to work independently or cooperatively in the team as required.
	9-3. Be able to organize, coordinate and lead the team to carry out work in the interdisciplinary context.
<p>Requirement 10: Communication: Be able to communicate and communicate with industry peers and the public on complex engineering problems of electrical control system in equipment manufacturing and related engineering fields, including writing reports and design documents and statement statements, clearly expressing or responding to instructions, and having a certain international vision, and being able to communicate in cross-cultural background.</p>	10-1. Be able to use language tools to accurately express their views and effectively communicate with peers in the industry and the public.
	10-2. Be able to understand international development trends and hot issues in equipment manufacturing industry and related engineering fields.
	10-3. Be able to understand and respect cultural differences, and be able to conduct basic communication and exchange on complex engineering issues related to electrical control in a cross-cultural context.
<p>Requirement 11: Project management: Understand and master the principles of engineering management and economic decision-making methods, and be able to apply them in a multidisciplinary environment.</p>	11-1. Understand and master certain engineering management principles and economic decision methods.
	11-2. Be able to effectively analyze and comprehensively evaluate complex engineering problems related to electrical control by applying engineering management principles and economic decision-making methods.
<p>Requirement 12: Lifelong learning: Have the consciousness of self-learning and lifelong learning, have the ability of continuous learning and adapting to development.</p>	12-1. Be able to recognize the necessity of continuous exploration and learning under the background of social development, and have the awareness of autonomous learning and lifelong learning.
	12-2. Have the ability of independent learning, including the ability to understand, summarize and ask questions; Master the language tools and computer tools of lifelong learning, and be physically and mentally healthy to adapt to various tasks at work.

### The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives			
	Educational Objectives 1	Educational Objectives 2	Educational Objectives 3	Educational Objectives 4
1: Engineering Knowledge	√			
2: Problem Analysis	√			
3: Design/Development Solutions	√			

4: Research		√		
5: Use Modern Tools		√		
6: Engineering and Society		√		
7: Environment and Sustainable Development			√	
8: Career Planning			√	
9: Individuals and Teams			√	
10: Communicate			√	√
11: Project Management			√	
12: Lifelong Learning				√

#### **IV. Major Subject**

Electrical engineering

#### **V. Core Courses**

Fundamentals of Circuit Analysis, Analog Electronic Technology, Digital Electronic Technology, Fundamentals of Electric Machinery and Drive, Automatic Control Theory, Fundamentals of Power System Analysis, Power Electronics, Technology of Electric Control, Motion Control System.

#### **VI. Educational System**

The basic length of undergraduate education is 2 years, which is managed according to the credit system.

#### **VII. Confer Degrees**

Students are required to complete at least \*91.0\* credits before graduation. The Bachelor of Engineering degree can be granted to those who meet the requirements of the Relevant Provisions on the Awarding of Bachelor's Degree for Graduates of Shenyang University of Chemical Technology (revised in March 2017).

## VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit requirement	Subtotal	Proportion (%)
General Education	General Education (Compulsory)	Ideological and Political Courses	Compulsory	10	23.5	25.82
		Foreign Language Courses		6		
		Computer Courses		2.5		
		Military and Safety Courses		2		
		Labor and Sport Education		1		
		Innovation and Entrepreneurship		1		
		Mental Health		1		
	General Education (Optional)	Aesthetic Education(400)	Optional	1	5	5.49
		China and the World(500)		1-3		
		Four Histories(600)		1		
		Economic Management(700)		1		
		Traditional Culture(900)		1		
General Education (Practice)	Military Training	Practice	2	2	2.00	
Discipline Education	Basic Courses	Public Basic Class	Compulsory	26.5	27.0	29.67
		Professional Foundation				
	Basic Practice Sessions	-	Practice	0.5		
Specialized Education	Core Courses	-	Compulsory	10.5	33.5	36.81
	Optional Courses	-	Optional	2		
	Specialized Practice Sessions	-	Practice	21		
Extracurricular links	Extracurricular General Education Practice	Culture and Society Practice	Extracurricular Practice	4		
		Mentally and Physically Practice				
		Foreign Language Proficiency Training Practice				
	Extracurricular Characteristic Practice	Innovative Training		4		
		Innovation Competition				
		Chuangke Activities				
	Career Education	Growth Planning Courses		1		
Total/Proportion					91.0	100

## 九、电气工程及其自动化专业教学进程表

### Table of Teaching Schedule for Electrical Engineering and Automation Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th			
通识教育课 General Education	必修 Compulsory	思政类 Ideological and Political Courses	0710053003	中国近现代史纲要   Outline of Chinese Contemporary and Modern History	3.0	48	32			16	2						
			0710103003	马克思主义基本原理*   Basic Principles of Marxism*	3.0	48	32			16		2					
			0710123001	习近平新时代中国特色社会主义思想概论    Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8				3			
			0710011303	形势与政策   Current Situation and Policies	1.0	32	32					1	1	1	1		
		外语类 Foreign Language Courses	0211003103	大学外语I   College English I	3.0	48	48					3					
			0211003203	大学外语II   College English II	3.0	48	48						3				
		计算机类 Computer Courses	1541372004	C 语言程序设计    C Programming Language	2.5	44	32		12			2					
		军事安全类 Military and Safety Courses	0710081003	军事理论   Military Theory	1.0	16	16					2					
			1510261303	安全教育   Safety Education	1.0	16	16						2				

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th		
通识教育课 General Education	必修 Compulsory	劳动教育类 Labor Education	2640021003	劳动教育   Labour Education	1.0	16	16					2				
		创新创业类 Innovation and Entrepreneurship courses	1557011003	创造性思维与创新方法   Creative Thinking and Innovative Methods	1.0	16	16						2			
		心理健康类 Mental Health Courses	0510041003	大学生心理与健康教育   Mental and Health Education for College Students	1.0	16	16				2					
		小计 Subtotal			23.5	396	344	0	12	40	10.5	8	4	1	23.5	
	选修 Optional	分为经济管理类（1.0）、美育类（1.0）、四史（1.0）、传统文化（1.0）、中国与世界（1.0）课程类5个模块 每个模块最多选修2.0学分，每学期最多选修2门课程。 Including 6 modules: Economic Management, Aesthetic Education, Science and Technology, Four Histories, Traditional Chinese Culture, China and The world. Up to 2.0 credits per module and up to 2 courses per semester.														
	小计 Subtotal			5.0												
	实践 Practice		0415102013	军训   Military Training	2.0	48				48	2				必选	
合计 Total					30.5	444	344	0	12	88	12.5	8	4	6	30.5	
学科平台课 Discipline Education	必修 Compulsory	数学与自然科学类 Natural Science & Mathematics	0310002103	高等数学 I*   Advanced Mathematics I*	2.0	32	32				2					
			0310002203	高等数学 II*   Advanced Mathematics II*	2.0	32	32					2				
			0310032003	线性代数    Linear Algebra	2.0	32	32					3				
			0310042003	概率论与数理统计   Probability and Statistics	2.0	32	32						2			

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	
学科平台课 Discipline Education	必修 Compulsory	工程基础类 Foundation Engineering	1540163004	电路分析基础*    Fundamentals of Circuit Analysis*	3.0	48	48				3				
			1540913004	模拟电子技术*    Analogue Electronic Technology*	3.0	52	40	12			3				
			1540923004	数字电子技术*    Digital Electronic Technology*	3.0	52	40	12				3			
		专业基础类 Subject Foundation Requisite	1511024004	自动控制原理*    The Principle of Automatic Control*	4.0	68	56	8	4			4			
			1512102004	电力电子技术*    Power Electronics *	2.5	44	32	12				2			
			1512852004	电机及拖动基础    Fundamentals of Electric Machinery and Drive	3.0	50	44	6				3			
		小计 Subtotal				26.5	442	388	50	4	0	10	16.5	0	0
	实践 Practice	1540150014	电路分析基础实验    Circuit Analysis Experiment	0.5	12		12				+2				
		小计 Subtotal				0.5					0.5				
	合计 Total					27.0	454	388	62	4	0	10.5	16.5	0	0
	专业教育课 Specialized Education	必修 Compulsory	1522352004	电气控制技术*    Electrical Control Technology*	2.5	42	36	6						3	
1522362004			可编程控制器原理与应用    The Principle and Application of Programmable Controller	2.5	44	32	12						4		
1522372004			运动控制系统*    Motion Control System*	2.5	44	32	12						3		
1522413004			电力系统分析基础    Fundamentals of Electric Power System	3.0	50	44	6					4			

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes	
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th		
专业教育课 Specialized Education		小计 Subtotal		10.5	180	144	36	0	0	0	3	7.5	0		
	选修 Optional	1547042004	计算机网络与通信技术   Computer Network and Communication Technology	2.0	32	32						2			
		1544302004	信号与系统II    Signals and Systems II	2.0	34	28	6			3					
		1536252004	VB 程序设计   Visual Basic Program Design	2.0	36	24					2				
		1531383004	现代控制理论   Modern Control Theory	3.0	52	40	8	4					3		
		1543112004	单片机应用基础   MCU Application Basis	2.0	34	28	6				2				
		小计 Subtotal		2.0											
	(此处填写修读要求 Fill in the Study Requirements)														
	实践 Practice	1512242024	电机调速系统设计   Design of Motor Speed control System	2.0	48		48						+2		
		1512292024	电气控制技术设计   Design of electrical control technology	3.0	72		72						√		
		1512272024	PLC 系统实训    PLC System Training	2.0	48		48						+2		
		1512224044	毕业设计(论文)   Graduation Design (Thesis)	14	336		336								+14
		小计 Subtotal		21.0	504	0	504	0	0	0	0	0	7	14	
	合计 Total				33.5	684	144	540	0	0	0	3	16.5	14	33.5
	总计 Sum				91.0	1582	876	602	16	88	23	27.5	20.5	20	91.0

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	
课外环节 Extracurricular links	课外实践 Extracurricular practice	人文社会实践 Culture and Society Practice	1513401033	社会调查   Social Survey	0.5	12				12					分散
		身心健康社会实践 Mentally and Physically Practice	0410050751	课外体育锻炼   Extracurricular Physical Exercise	0.5	12				12					分散
			2640030013	劳动教育实践   Labour Education Practice	0.5	12				12	0.5				分散
			0510070311	心理健康辅导   Mental Health Counseling	0.5	12				12					分散
课外环节 Extracurricular links	课外实践 Extracurricular practice	外语技能实践类 Foreign Language Proficiency Training Practice	0210010013	外语技能实践（初级）   Foreign Language Proficiency Training Practice（Elementary）	2.0	48				48				2	(2选1) 分散
			0210020013	外语技能实践（高级）   Foreign Language Proficiency Training Practice（Advanced）	2.0	48				48				2	
		能力与创新实践 Capability and Innovation Practice	1541712024	大学生素质拓展与创新实践   Quality Development and Innovation Practice	4.0	96				96	1~4 学期依据《沈阳化工 大学创新创业实践学分认 定办法》由创新创业学院认 定				分散
	成长规划类 Growth Planning Courses	1540271314	职业规划与就业指导   Career Planning and Employment Guidance	1.0	40	40				1					分散
小计 Subtotal															

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5，课程名称中画\*为考试课。



## 十、电气工程及其自动化专业学士学位课程一览表

**A list of bachelor's degree programs in Electrical Engineering and Automation**

课程类别 Course Type	模块名称 Modules	序号 No.	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester
通识教育课 General Education	政治理论 Political Theory	1	0710103003	马克思主义基本原理*   Elementary Theory of Marxism*	3.0	2
学科平台课 Discipline Education	数学 Mathematics	2	0310002103	高等数学I*   Advanced Mathematics I*	2.0	1
	工程基础 Foundations of Engineering	3	1540163004	电路分析基础*   Fundamentals of Circuit Analysis*	3.0	1
		4	1540923004	数字电子技术*   Digital Electronic Technology*	3.0	2
	专业基础 Subject Foundation Requisite	5	1511024004	自动控制原理*   The Principle of Automatic Control*	4.0	2
		6	1512102004	电力电子技术*   Power Electronics*	2.5	2
专业教育课 Specialized Education	电气控制 Electrical Control	7	1522352004	电气控制技术*   Technology Electrical Control Technology*	2.5	3
		8	1522372004	运动控制系统*   Motion Control System*	2.5	3

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》

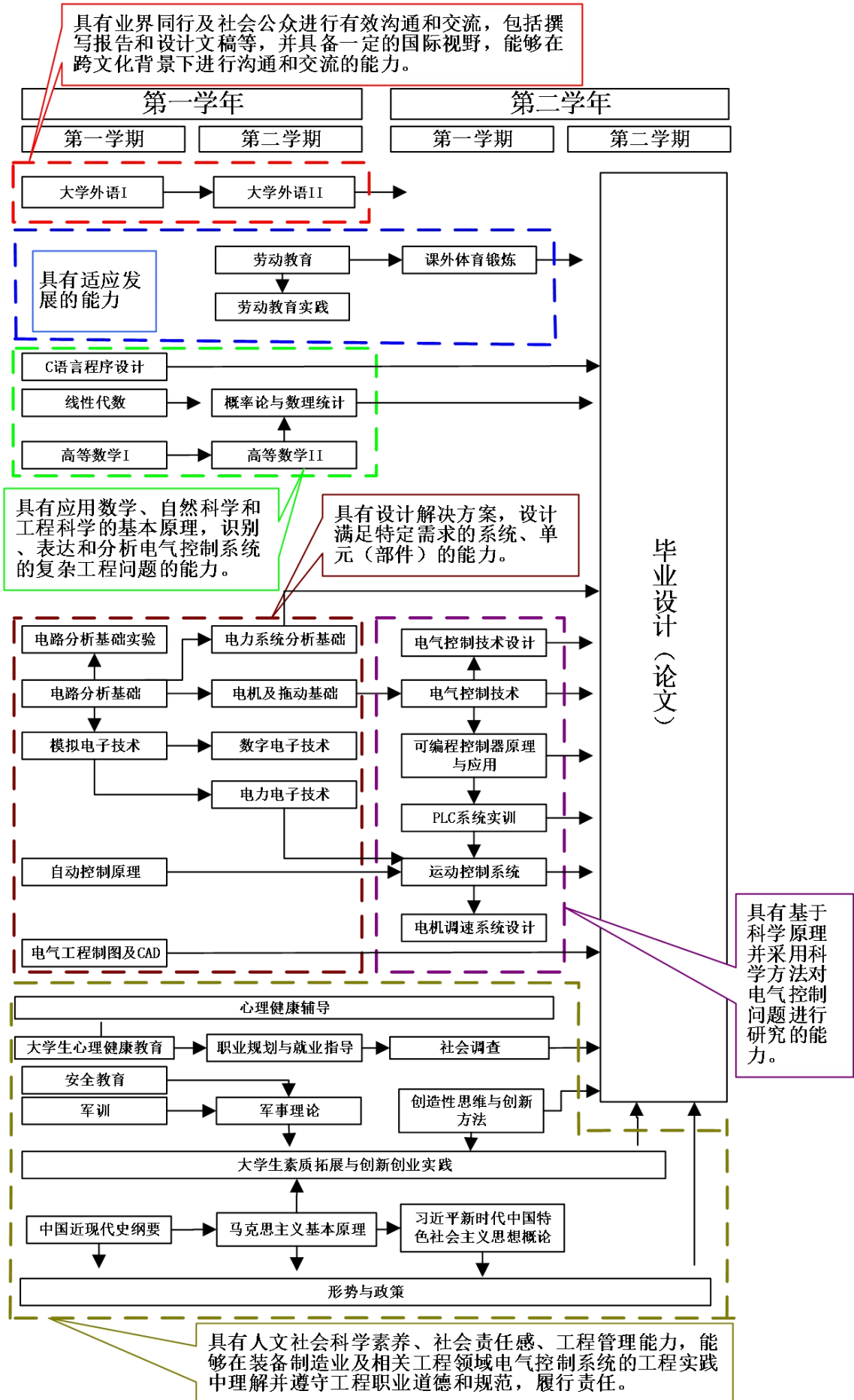
### 十一、全学程实践环节周历安排 Weekly Calendar of all Practice Sessions

学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注
一		☆	☆															::	::	.		
二																		::	::	.		
三	△	△	△	△			△	△										::	::	.		
四	=	=	=	=	=	=	=	=	=	=	=	=	=	=								

符号说明(Symbol Description):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P 各类实训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼ 认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计(论文)||Graduation Project(Thesis)    ·小学期||Primary Term

## 十二、课程体系配置图 Curriculum System Configuration Diagram



十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements ( High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																	
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	10.3	11.1	11.2	12.1	12.2	
中国近现代史纲要   Outline of Chinese Contemporary and Modern History																						M												
马克思主义基本原理*   Basic Principles of Marxism*																						M												
习近平新时代中国特色社会主义思想概论    Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																						M												
形势与政策   Current Situation and Policies																						M							M	M				
大学外语   College English																											M		M					M
C 语言程序设计   C Language Programming																L																		M
军事理论   Military Theory																						M												
安全教育   Safety Education										M								M													L	L		
劳动教育   Labour Education																						L		M		M								



课程 (Courses)	毕业能力要求 (Graduation Requirements)																																		
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	10.3	11.1	11.2	12.1	12.2		
电路分析基础实验   Circuit Analysis Experiment		M			L	L																			M										
电气控制技术*   Technology Electrical Control Technology*			H	M															M							M									
可编程控制器原理与应用   The Principle and Application of Programmable Controller				M					M							L																			
运动控制系统*    Motion Control System*			L	H							M		L																						
电力系统分析基础   Fundamentals of Electric Power System					M																											M			
电机调速系统设计   Design of Motor Speed Control System								M					M	M												M									
电气控制技术设计   Design of Electrical Control Technology								L				L						M		L													L		
PLC 系统实训   PLC System Training										L		M				L																		M	
毕业设计 (论文)   Graduation Design (Thesis)							H	M					M			H				M							M	M				M		M	

# 沈阳化工大学专升本培养方案

## 信息工程学院

专业名称：自动化

专业代码：080801

制 定：郭小萍

审 核：孔晓光

审 定：于三三

批 准：金志浩

2021 年 8 月

# 自动化专业专升本培养方案

## 一、培养目标

本专业培养能在流程工业等领域从事自动化系统的分析、设计、开发、运行及管理等方面工作的高素质应用型工程技术人才。

毕业 5 年后的学生：

(1) 具有扎实的理论基础，具备适应自动化工程技术发展及职业拓展需求的能力，能够综合运用数学等自然科学、专业知识及交叉学科知识，分析自动化及相关领域中的复杂工程问题并提供系统性解决方案；

(2) 能够运用现代工具理解和解决复杂流程工业过程自动控制系统的分析、设计、集成和服务等实际工程问题；

(3) 具有高度的社会责任感、健全的人格、良好的人文科学素养、和谐包容的团队精神、有效的沟通与表达能力和工程项目管理能力，在工程实践中能综合考虑法律、环境与可持续性发展等因素，具有坚持公众利益优先的素质；

(4) 具有广阔的国际视野，主动适应不断变化的国内外形势和环境，能够通过多种学习渠道更新知识，形成终生学习的习惯。

## 二、专业方向

过程控制。

## 三、毕业要求

根据本专业人才培养目标以及我校自动化学科多年的人才培养经验，从适应社会发展的需求出发，明确现阶段本专业的毕业能力要求及其指标点分解：

毕业能力要求	指标点
毕业要求 1： 工程知识：掌握数学、自然科学、工程基础和自动化专业知识，能够运用其理论和方法解决流程工业信息化、自动化相关的复杂工程问题。	1-1.能将数学、自然科学、工程基础和专业知识运用到复杂工程问题的恰当表述中。
	1-2.能针对一个系统或过程建立合适的数学模型，并利用恰当的方法进行求解。
	1-3.能将工程基础和专业知识用于流程工业过程的判别和分析。
	1-4.能将工程基础和专业知识用于流程工业过程的设计、控制和改进。
毕业要求 2： 问题分析：能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究分析流程工业信息化、自动化相关的复杂工程问题，以获得有效结论。	2-1.能运用数学、自然科学和工程科学的基本原理，识别流程工业信息化、自动化相关的复杂工程问题中的关键环节。
	2-2.能通过建立数学模型、稳定性分析、系统集成分析、基于工艺和设备运行操作指标分析等方法正确表达流程工业信息化、自动化相关的复杂工程问题。
	2-3.能通过文献研究来分析流程工业信息化、自动化相关的复杂工程问题，以获得有效结论。
毕业要求 3： 设计/开发解决方案：在综合考虑社会、健康、安全、法律、文化以及环境等因素的前提下，能够针对流程工业信息化、自动化相关的复杂工程问题设计解决方案，设计满足特定需	3-1.能够根据用户需求确定设计目标，并能够在安全、环境、法律等现实约束条件下，对设计方案的可行性进行研究。
	3-2.能够通过建模进行工艺计算，集成单元过程进行流程控制设计，并对流程过程设计方案进行优选，体现创新意识。



求的系统、单元（部件），并能够在设计环节中体现创新意识。	3-3.掌握单元、系统等自动化工程设计知识，能够应用其针对流程工业信息化、自动化相关的复杂工程问题设计解决方案。
<b>毕业要求 4:</b> 研究：能够基于科学原理并采用科学方法对流程工业信息化、自动化相关的复杂工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。	4-1.能够基于专业理论，根据对象特性，选择研究路线。
	4-2.能够基于先进控制方法、过程监控方法对流程工业信息化、自动化相关的复杂工程问题设计实验方案，开展实验，分析与解释数据。
	4-3.能够针对流程工业信息化、自动化相关的复杂工程问题进行控制系统应用研究，并通过信息综合得到合理有效的结论。
<b>毕业要求 5:</b> 使用现代工具：掌握文献检索、资料查询以及运用现代信息技术获取相关信息的基本方法，能够针对流程工业信息化、自动化相关的复杂工程问题，开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具，包括对流程工业信息化、自动化相关的复杂工程问题的预测与模拟，并能够理解其局限性。	5-1.掌握文献检索、资料查询以及运用现代信息技术获取相关信息的基本方法。
	5-2.能正确开发、选择与使用仿真工具、人机界面集成工具等技术、资源，对流程工业信息化、自动化相关的复杂工程问题进行预测与模拟。
	5-3.在解决流程工业信息化、自动化相关的复杂工程问题实践中提高现代工具的应用能力，并能够理解其局限性。
<b>毕业要求 6:</b> 工程与社会：能够基于流程工业信息化、自动化相关的背景知识进行合理分析，评价专业工程实践和复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。	6-1.掌握社会、健康、安全、法律以及文化等方面的相关知识，能够基于流程工业信息化、自动化相关的背景知识进行合理分析。
	6-2.亲身体验并评价工程实践和工程方案对社会、健康、安全、法律以及文化的影响，理解在流程工业信息化、自动化相关工程实践中应承担的责任。
<b>毕业要求 7:</b> 环境和可持续发展：能够理解和评价针对流程工业信息化、自动化相关的复杂工程问题的工程实践对环境、社会可持续发展的影响。	7-1.理解和亲身体验针对流程工业信息化、自动化相关的复杂工程问题的工程实践对环境、社会可持续发展的影响。
	7-2.运用环境与可持续发展等相关法律法规分析、评价针对流程工业信息化、自动化相关的复杂工程问题的工程实践对环境、社会可持续发展的影响。
<b>毕业要求 8:</b> 职业规范：具有人文社会科学素养、社会责任感，能够在流程工业信息化、自动化的工程实践中理解并遵守工程职业道德和规范，履行责任。	8-1.培养良好的世界观、人生观；了解国家与社会发展。
	8-2.具有良好的人文社会科学素养、社会责任感。
	8-3.理解工程师的职业性质和责任；在流程工业信息化、自动化的工程实践中遵守工程职业道德和规范，并履行责任。
<b>毕业要求 9:</b> 个人和团队：能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。	9-1.能够在多学科背景下的团队中承担个体角色并发挥个体优势。
	9-2.能够在多学科背景下的团队中承担团队成员角色并发挥团队协作精神。
	9-3.能够在多学科背景下的团队中承担团队负责人角色并发挥管理能力。
<b>毕业要求 10:</b> 沟通：能够就流程工业信息化、自动化相关的复杂工程问题与业界同行及社会公众进行有效沟通和交流，包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令，并具备一定的国际视野，能够在跨文化背景下进行沟通和交流。	10-1.具备外语交流能力，具有一定的国际视野，能够在跨文化背景下进行沟通和交流。
	10-2.能够熟练阅读专业外语文献资料，就流程工业信息化、自动化相关的复杂工程问题与业界同行及社会公众有效地进行口头和书面的信息交流。

毕业要求 11： 项目管理：理解并掌握工程管理原理与经济决策方法，并能在多学科环境中应用。	11-1.理解并掌握一定的工程管理原理与经济决策方法。
	11-2.能够应用工程管理原理与经济决策方法对流程工业信息化、自动化相关的复杂工程问题进行有效分析和综合评价。
毕业要求 12：终身学习：具有自主学习和终身学习的意识，有不断学习和适应发展的能力。	12-1.掌握终身学习的语言工具和计算机工具，具有自主学习能力，能够通过自主查阅资料，获取解决问题的知识和方法。
	12-2.充分认识到流程工业信息化、自动化相关的工程领域的快速发展以及自主学习、终身学习的重要性，具有健康良好的心理、身体素质，以适应工作中的各种任务。

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。

### 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标			
	培养目标 1	培养目标 2	培养目标 3	培养目标 4
1: 工程知识	√			√
2: 问题分析	√	√		
3: 设计/开发解决方案	√	√		
4: 研究		√		√
5: 使用现代工具		√		√
6: 工程与社会		√	√	
7: 环境和可持续发展			√	
8: 职业规范			√	
9: 个人和团队			√	
10: 沟通			√	√
11: 项目管理			√	
12: 终身学习			√	√

## 四、主干学科

控制科学与工程

## 五、专业核心课程

电路分析基础、数字电子技术、模拟电子技术、自动控制原理、现代控制理论、过程检测技术与传感器、过程建模技术、过程控制工程、计算机控制技术。

## 六、修业年限

本科基本学制 2 年，弹性学习年限 1-4 年，按照学分制度管理。

## 七、授予学位

学生应至少修满 93 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者，可授予工学学士学位。

## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例 (%)
通识教育课	通识教育必修课	思政类	必修	10	23.5	25.27
		外语类		6		
		计算机类		2.5		
		军事安全类		2		
		劳动体育类		1		
		创新创业类		1		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	1	5	5.38
		中国与世界(500)		1		
		四史(600)		1		
		经济管理类(700)		1		
		传统文化(900)		1		
	通识教育实践课	军训	实践	2	2	2.15
	学科平台课	学科基础课程	公共基础类	必修	23.5	24
专业基础类						
学科实践课程		-	实践	0.5		
专业教育课	专业核心课程	-	必修	14.5	38.5	
	专业选修课程	-	选修	2		
	专业实践课程	-	实践	22		
课外环节	课外通识实践	人文社会实践	课外实践	4		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
	生涯教育	成长规划类		1		
总学分/比例					93	100

# Automation Major 2021 Upgrading from Junior College to Undergraduate Education Program

## I. Educational Objectives

This major trains high-quality applied engineering and technical personnel who can be engaged in the analysis, design, development, operation and management of automation systems in process industries and other fields.

Students 5 years after graduation:

(1) Have a solid theoretical foundation, have the ability to adapt to the development of automation engineering technology and career development needs, be able to use mathematics and other natural science, professional knowledge and interdisciplinary knowledge to analyze complex engineering problems in automation and related fields and provide systematic solutions;

(2) Be able to use modern tools to understand and solve practical engineering problems such as analysis, design, integration and service of complex process control system;

(3) Have a high sense of social responsibility, sound personality, good humanity literacy, harmonious and inclusive team spirit, effective communication and expression ability and project management ability. In engineering practice, have the quality to comprehensively consider factors such as law, environment and sustainable development, and give priority to public interests;

(4) Have a broad international vision, actively adapts to the changing situation and environment at home and abroad, can update knowledge through a variety of learning channels, and forms the habit of lifelong learning.

## II. Major direction

Process control

## III. Graduation Requirements

According to the talent training objectives of this major and the many years of talent training experience of Automation Discipline in our university, starting from the needs of social development, it is clear that the graduation requirements of this major at this stage are as follows:

Graduation Requirements	Indices
Requirement 1: Having the ability of applying mathematics, natural science, engineering foundation and automation expertise to solving complicated engineering problems such as engineering design, system integration, operation and maintenance, and technical service of automation systems, and understanding the frontier development status and trends of the automation industry.	1.1 Be able to apply mathematics, natural science, engineering foundation and professional knowledge to the proper expression of complex engineering problems.
	1.2 Be able to establish appropriate mathematical model for a system or process and solve it with appropriate methods.
	1.3 Be able to apply engineering foundation and professional knowledge to process identification and analysis in process industry.
	1.4 Be able to apply engineering foundation and professional knowledge to the design, control and improvement of process industry.

<p>Requirement 2: The ability to identify and extract, define and express, analyze by document research the complex engineering problems such as engineering design, system integration, operation and maintenance, and technical service of the automation system with relevant knowledge, obtaining the valid conclusion.</p>	<p>2.1 Be able to use the basic principles of mathematics, natural science and engineering science to identify the key links in complex engineering problems related to process industry informatization and automation.</p>
	<p>2.2 Be able to correctly express complex engineering problems related to informatization and automation of process industry by establishing mathematical model, stability analysis, system integration analysis, process and equipment operation index analysis, etc.</p>
	<p>2.3 Be able to analyze complex engineering problems related to informatization and automation of process industry through literature research, so as to obtain effective conclusions.</p>
<p>Requirement 3: Designing for systems, components and processes with complex engineering problems such as automation systems engineering design integration, taking into account social, health, safety, legal, cultural and environmental factors. The designs reflect the sense of innovation.</p>	<p>3.1 Be able to determine the design objectives according to the needs of users, and be able to study the feasibility of the design scheme under the realistic constraints of safety, environment and law.</p>
	<p>3.2 Be able to carry out process calculation through modeling, integrate unit process to carry out process control design, and optimize process design scheme to reflect innovation consciousness.</p>
	<p>3.3 Master the knowledge of unit and system automation engineering design, and be able to apply it to design solutions for complex engineering problems related to process industry informatization and automation.</p>
<p>Requirement 4: Based on scientific principles and scientific methods, studying complex engineering problems such as engineering design integration, operation and maintenance, technical service and so on, including designing experiments, analyzing and interpreting data, and obtaining reasonable and valid conclusions through information synthesis.</p>	<p>4.1 Be able to choose research routes based on professional theory and object characteristics.</p>
	<p>4.2 Be able to design experimental schemes, carry out experiments, analyze and interpret data for complex engineering problems related to process industry informatization and automation based on advanced control methods and process monitoring methods.</p>
	<p>4.3 Be able to study the application of control system for complex engineering problems related to process industry informatization and automation, and get reasonable and effective conclusions through information synthesis.</p>
<p>Requirement 5: Having the ability to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for engineering practice, including the prediction and simulation of complex engineering problems, and understanding its limitations, in solving automation system engineering design integration, operation and maintenance, technical services and other complex engineering problems.</p>	<p>5.1 Master the basic methods of document retrieval, data inquiry and the use of modern information technology to obtain relevant information.</p>
	<p>5.2 Be able to correctly develop, select and use simulation tools, human-computer interface integration tools and other technologies and resources, and predict and simulate complex engineering problems related to process industry informatization and automation.</p>
	<p>5.3 Improve the application ability of modern tools in solving complex engineering problems related to process industry informatization and automation, and understand its limitations.</p>

<p>Requirement 6:</p> <p>In solving complicated engineering problems such as engineering design and integration of automation systems, operation and maintenance, and technical services, analyzing rationally on the basis of engineering background knowledge, understanding and evaluate the impact on health, safety, law and culture in engineering practice and understanding the corresponding responsibility.</p>	<p>6.1 Master the relevant knowledge of society, health, safety, law and culture, and be able to make reasonable analysis based on the background knowledge of process industry informatization and automation.</p>
	<p>6.2 Personally experience and evaluate the impact of engineering practice and engineering scheme on society, health, safety, law and culture, and understand the responsibilities in process industry informatization and automation related to engineering practice.</p>
<p>Requirement 7:</p> <p>Having the ability of understanding and evaluating the impact of engineering practice on resources, environment and social sustainable development in the complex engineering problems of automation system engineering design and integration, operation and maintenance, and technical service, and constructing and implementing both environmental protection and green production efficiency of automated systems engineering.</p>	<p>7.1 Understand and experience the impact of engineering practice on the sustainable development of environment and society on complex engineering problems related to process industry informatization and automation.</p>
	<p>7.2 Analyze and evaluate the impact of engineering practice on the sustainable development of environment and society by using relevant laws and regulations such as environment and sustainable development.</p>
<p>Requirement 8:</p> <p>With humanities and social science literacy, social responsibility in engineering practice, understanding and complying with engineering ethics and norms, fulfill the responsibilities.</p>	<p>8.1 Cultivate a good world outlook and outlook on life; Understand national and social development.</p>
	<p>8.2 Have good humanities and social science literacy and sense of social responsibility.</p>
	<p>8.3 Understand the professional nature and responsibilities of engineers; In the process industry informatization, automation engineering practice, abide by the engineering professional ethics and norms, and fulfill the responsibility.</p>
<p>Requirement 9:</p> <p>Good team spirit and ability to play a role in multidisciplinary context and to correctly understand and handle the relationship between individuals, teams and people in charge.</p>	<p>9.1 Be able to play an individual role and give full play to individual advantages in a multidisciplinary team.</p>
	<p>9.2 Be able to play the role of a member in team cooperation in a multidisciplinary team.</p>
	<p>9.3 Be able to play the role of team leader with management ability in a multidisciplinary team.</p>
<p>Requirement 10:</p> <p>Ability to communicate effectively with industry peers and the general public on complex engineering issues in the field of automation, including writing reports and design presentations, presenting statements, articulating or responding to directives. Having a certain degree of international communication skills in cross-cultural background.</p>	<p>10.1 Have the ability of foreign language communication, have a certain international vision, and be able to communicate and exchange in a cross-cultural context.</p>
	<p>10.2 Be able to skillfully read professional foreign language literature, and effectively exchange oral and written information with industry peers and the public on complex engineering issues related to process industry informatization and automation.</p>

Requirement 11: Ability to understand and master the basic knowledge of project management and economic decision-making and basic methods, and to apply to multidisciplinary engineering practice.	11.1 Understand and master certain engineering management principles and economic decision-making methods.
	11.2 Be able to effectively analyze and comprehensively evaluate complex engineering problems related to informatization and automation of process industry by applying engineering management principles and economic decision-making methods.
Requirement 12: Life-long learning: Ability to adapt to social development and meet the needs of the individual development. The consciousness of independent learning and lifelong learning.	12.1 Master the language tools and computer tools of lifelong learning, have the ability of self-learning, and be able to obtain the knowledge and methods of solving problems through self-access to information.
	12.2 Fully realize the rapid development of process industry informatization and automation related to engineering fields, as well as the importance of autonomous learning and lifelong learning, and have good psychological and physical quality to adapt to various tasks in the work.

### The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives			
	Educational Objectives 1	Educational Objectives 2	Educational Objectives 3	Educational Objectives 4
1: Engineering Knowledge	√			√
2: Problem Analysis	√	√		
3: Design/Development Solutions	√	√		
4: Research		√		√
5: Use Modern Tools		√		√
6: Engineering and Society		√	√	
7: Environment and Sustainable Development			√	
8: Career Planning			√	
9: Individuals and Teams			√	
10: Communicate			√	√
11: Project Management			√	
12: Lifelong Learning			√	√

#### IV. Major Subject

Control Science and Engineering

#### V. Core Courses

Fundamentals of Circuit Analysis, Electronic Technology, Automatic Control Theory, Modern Control Theory, Process Detecting Technology and Sensor, Process Control Engineering, Computer Control Technology, Process Modelling Technology, etc.

## **VI. Educational System**

The basic length of undergraduate education is 2 years, and the flexible study period is 1-4 years. It is managed according to the credit system.

## **VII. Confer Degrees**

Students should complete at least 93 credits before graduation. The Bachelor degree of engineering can be granted to those who meet the degree awarding requirements of the relevant regulations on the awarding of bachelor's degree for graduates of Shenyang University of Chemical Technology (revised in March 2017).



## VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit Requirement	Subtotal	Proportion (%)
General Education	Subject Platform Course General Education Compulsory Course	Ideological and Political Education	Compulsory	10	23.5	25.27
		Foreign Languages		6		
		Computer		2.5		
		Military Security		2		
		Labor Sports		1		
		Innovation and Entrepreneurship		1		
		Mental Health		1		
	General Education Elective Subjects	Aesthetic Education (400)	Elective	1	5	5.38
		China and the World (500)		1		
		Four Histories (600)		1		
		Economic Management(700)		1		
		Traditional Culture (900)		1		
	General Education Practice Course	Military Training	Practice	2	2	2.15
	Discipline Education	Basic Subject Courses	Public Basic Class	Compulsory	23.5	24.0
Professional Foundation						
Subject Practice course		-	Practice	0.5		
Specialized Education	Professional Core Courses	-	Compulsory	14.5	38.5	67.2
	Professional Elective Courses	-	Elective	2		
	Professional Practice Courses	-	Practice	22		
Extracurricular	Extracurricular General Knowledge Practice	Humanistic Social Practice	Extracurricular Practice	4		
		Physical and Mental Health Practice				
		Foreign Language Skills Practice				
	Innovation and Entrepreneurship Practice	Innovation Training		4		
		Innovation Competition				
		Maker Activities				
	Career Education	Growth Planning		1		
Total Credits / Proportion					93	100

## 九、自动化专业教学进程表

### Table of Teaching Schedule for Automation Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th			
通识教育课 General Education	必修 Compulsory	思政类 Ideological and Political Courses	0710053003	中国近现代史纲要   Outline of Chinese Contemporary and Modern History	3.0	48	32			16	2						
			0710103003	马克思主义基本原理* Basic Principles of Marxism*	3.0	48	32			16		2					
			0710123001	习近平新时代中国特色社会主义思想概论 Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8				3			
			0710011303	形势与政策   Current Situation and Policies	1.0	32	32					1	1	1	1		
		外语类 Foreign Language Courses	0211003103	大学外语I   College EnglishI	3.0	48	48					3					
			0211003203	大学外语II   College English II	3.0	48	48						3				
		计算机类 Computer Courses	1541372004	C 语言程序设计    C Programming Language	2.5	44	32			12		2					
		军事安全类 Military and Safety Courses	0710081003	军事理论   Military Theory	1.0	16	16					2					
			1540261304	安全教育   Safety Education	1.0	16	16						2				
		劳动教育类 Labor Education	2640021003	劳动教育   Labour Education	1.0	16	16						2				

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	
通识教育课 General Education	必修 Compulsory	创新创业类 Innovation and Entrepreneurship courses	1547011004	创造性思维与创新方法   Creative Thinking and Innovative Methods	1.0	16	16					2			
		心理健康类 Mental Health Courses	0510041003	大学生心理与健康教育   Mental and Health Education for College Students	1.0	16	16			2					
		小计 Subtotal				23.5	396	344	0	12	40	12	10	6	1
	选修 Optional		分为经济管理类、美育类、四史、传统文化、中国与世界课程类 6 个模块 每个模块最多选修 2.0 学分，每学期最多选修 2 门课程。 Including 6 modules: Economic Management, Aesthetic Education, Science and Technology, Four Histories, Traditional Chinese Culture, China and The world. Up to 2.0 credits per module and up to 2 courses per semester.												
	小计 Subtotal				5.0	80	80								
	实践 Practice		0415102013	军训   military training	2.0	48				48					集中
合计 Total				30.5	524	424	0	12	88	12	10	6	1		
学科平台课 Discipline Education	必修 Compulsory	数学与自然科学类 Natural Science & Mathematics	0310002103	高等数学 I*   Advanced Mathematics I*	2.0	32	32				2				
			0310002203	高等数学 II*   Advanced Mathematics II*	2.0	32	32					2			
			0310032003	线性代数    Linear Algebra	2.0	32	32					3			
			0310042003	概率论与数理统计   Probability and Statistics	2.0	32	32						2		
		工程基础类 Foundation Engineering	1540163004	电路分析基础*   Fundamentals of Circuit Analysis*	3.0	48	48					3			
			1540913004	模拟电子技术*   Analogue Electronic Technology*	3.0	52	40	12				3			

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	
学科平台课 Discipline Education	必修 Compulsory	专业基础类 Subject Foundation Requisite	1540923004	数字电子技术*   Digital Electronic Technology*	3.0	52	40	12				3			
			1511024004	自动控制原理*   The Principle of Automatic Control*	4.0	68	56	8	4			4			
			1541383004	现代控制理论    Modern Control Theory	2.5	44	32	8	4				3		
			小计 Subtotal		23.5	392	344	40	8	0	11	11	3		
	实践		1540150014	电路分析基础实验   Circuit Analysis Experiment	0.5	12		12			2				
	小计 Subtotal		0.5	12		12									
	合计 Total		24	404	344	52	8	0	11	11	3				
专业教育课 Specialized Education	必修 Compulsory		1541422004	过程建模技术*   Process Modeling Technology*	2.5	42	36	4	2				3		
			1521074004	过程控制工程*   Process Control Engineering*	4.0	68	56	12					4		
			1521083004	计算机控制技术*    Computer Control Technology*	3.0	52	40	10	2				3		
			1521102004	集散控制系统(DCS)   Distributed Control System	2.5	44	32	12					3		
			1543042004	过程检测技术与传感器   Process Detection Techniques and Sensors	2.5	42	36	6					3		
			小计 Subtotal		14.5	248	200	44	4	0	0	0	16		
	选修 Optional		1547042004	计算机网络与通信技术   Computer Network and Communication Technology	2.0	32	32					2			
			1544302004	信号与系统II  Signals and SystemsII	2.0	34	28	6			3				

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th		
专业教育课 Specialized Education	选修 Optional		1542242004	电气控制技术   Electrical Control Technology	2.0	34	28	6				2				
			1542252004	工程电磁场   Engineering Electromagnetic Field	2.0	34	28	6			2					
			1543112004	单片机应用基础   MCU Application Basis	2.0	34	28	6			2					
			1543992004	机器人控制   Robot Control	2.0	36	24	12				2				
			小计 Subtotal				12	204	168	36	0	0	3	6	4	
			修读要求 Fill in the Study Requirements				2.0	32	32						2	
	实践 Practice		1541362024	控制工程课程设计   Course Design of Control Engineering	2.0	48		48					2			
			1541372024	计算机控制系统集成设计   Integrated Design of Computer Control System	2.0	48		48						2		
			1541162034	生产实习   Production Practice	2.0	48		48						2	集中	
			1541402024	工程实训   Engineering Practice	2.0	48		48						2		
			1541711044	毕业设计（论文）   Graduation Design (Thesis)	14	336		336						14	集中	
			小计 Subtotal				22.0	528	0	528	0	0	0	0	8	14
	合计 Total				38.5	808	232	572	4	0	0	3	21	14		
	总计 Sum					93	1736	1000	624	24	88	23	21	33	15	
	课外环节 Extracurricular links	课外实践 Extracurricular practice	人文社会实践 Culture and Society Practice	1543401034	社会调查   Social Survey	0.5	12				12				分散	

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	
课外环节 Extracurricular links	身心健康社会实践 Mentally and Physically Practice	0415102013	课外体育锻炼   Extracurricular Physical Exercise	0.5	12				12					分散	
		2640030013	劳动教育实践   Labour Education Practice	0.5	12				12		0.5			分散	
		0510070313	心理健康辅导   Mental Health Counseling	0.5	12				12					分散	
	外语技能实践类 Foreign Language Proficiency Training Practice	0210010013	外语技能实践（初级）   Foreign Language Proficiency Training Practice（elementary）	2.0	48				48				2	（2选1） 分散	
		0210020013	外语技能实践（高级）   Foreign Language Proficiency Training Practice（advanced）	2.0	48				48				2		
	能力与创新实践 Capability and Innovation Practice	1541712024	大学生素质拓展与创新实践   Quality Development and Innovation Practice	4.0	96				96	1~4 学期依据《沈阳化工 大学创新创业实践学分认 定办法》由创新创业学院认 定				分散	
	成长规划类 Growth Planning Courses	1540271314	职业规划与就业指导   Career Planning and Employment Guidance	1.0	40	40				1				分散	
小计 Subtotal															

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5，课程名称中画\*为考试课。

Note: “Cre. (Credits)”, “T.C.H. (Total Credit Hours)”, “Lec. (Lecture)”, “Exp. (Experiment)”, “Pro. (Programming)”, “Pra. (Practice)”.

## 十、自动化专业学士学位课程一览表

**A list of bachelor's degree programs in Automation Major**

课程类别 Course Type	模块名称 Modules	序号 No.	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester
通识教育课 General Education	政治理论 Political Theory	1	0710103003	马克思主义基本原理* Basic Principles of Marxism*	3.0	2
学科平台课 Discipline Education	数学 Mathematics	2	0310002103	高等数学 I* Advanced Mathematics I*	2.0	1
	工程基础 Engineering Foundation	3	1540163004	电路分析基础* Fundamentals of Circuit Analysis*	3.0	1
		4	1540923004	数字电子技术* Digital Electronic Technology*	3.0	2
		5	1511024004	自动控制原理* The Principle of Automatic Control*	4.0	2
		6	1541383004	现代控制理论 Modern Control Theory	3.0	3
专业教育课 Professional Education	过程控制 Process Control	7	1541422004	过程建模技术* Process Modeling Technology*	2.5	3
		8	1521074004	过程控制工程* Process Control Engineering*	4.0	2
		9	1521083004	计算机控制技术* Computer Control Technology*	3.0	3
		10	1521102004	集散控制系统(DCS) Distributed Control System	2.5	3

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》

### 十一、全学程实践环节周历安排 Weekly Calendar of all Practice Sessions

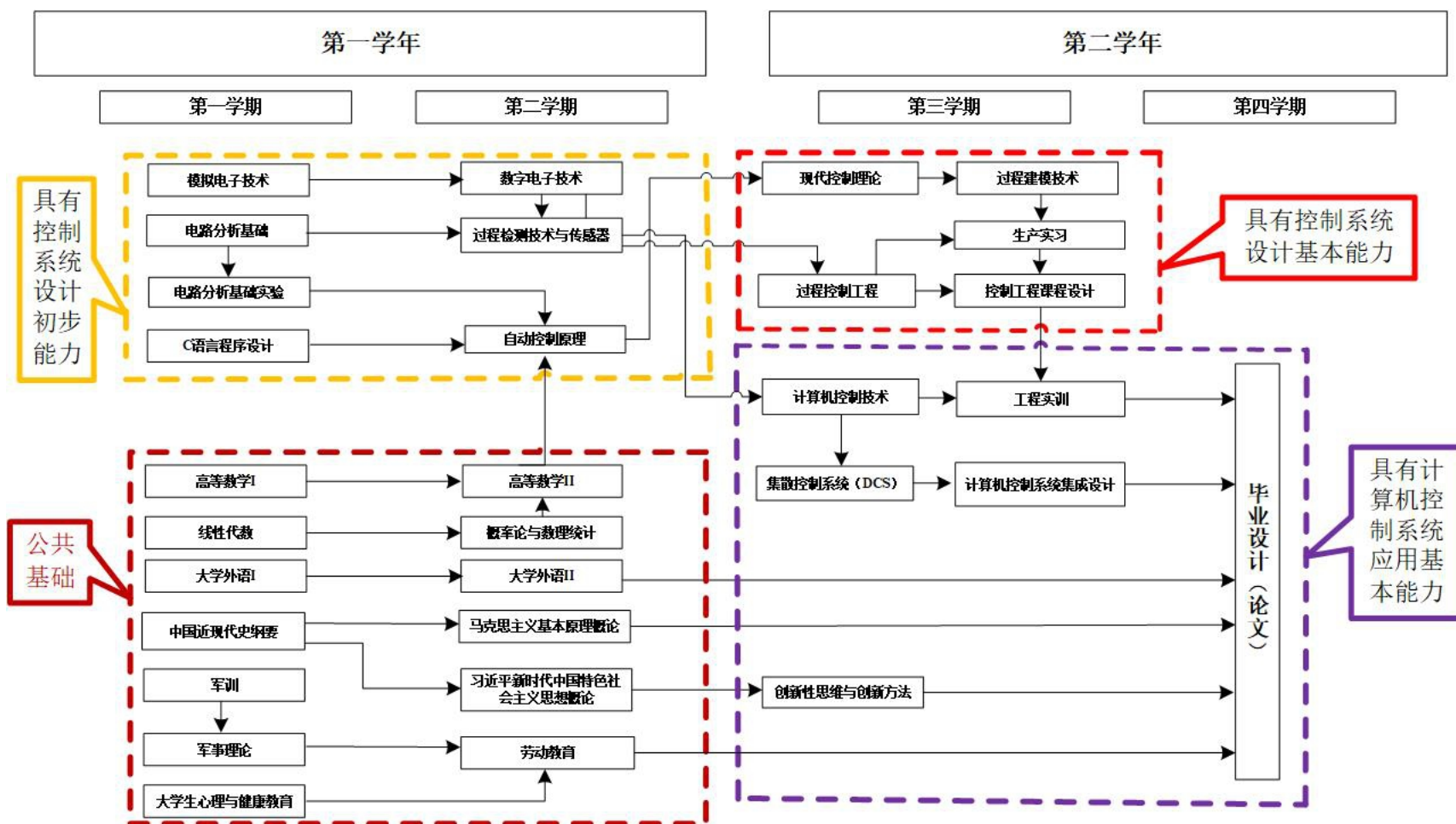
学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注
一		☆	☆															::	::			军训
二												△						::	::			
三	△	△	/	/			△	△	△	△												生产实习
四	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=					毕业设计

符号说明(Symbol Description):

※△课程设计||Curriculum Design /生产实习||Specialized Production Practice L 专业实验||Specialty Experiment P 各类实训、学年论文||Practical Training、Term Paper :: 考试||Examination ▼☆军训||Military Training = 毕业设计(论文)||Graduation Project(Thesis)



## 十二、课程体系配置图 Curriculum System Configuration Diagram



十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements (High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	11.1	11.2	12.1	12.2	
马克思主义基本原理概论*    Basic Principal of Marxism*																						M											
中国近现代史纲要   Outline of Chinese Contemporary and Modern History																						M											
习近平新时代中国特色社会主义思想概论 Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																						M											
大学外语   College English																												M					M
C 语言程序设计   C Programming Language															M																	M	
高等数学I-II    Advanced Mathematics I-II	M	M	L	L																													
线性代数    Linear Algebra	L	M	L	L	M																												
概率论与数理统计    Probability and Statistics		M			M																												
电路分析基础*    Fundamentals of circuit analysis*		M				M																											
模拟电子技术*   Analog electronic technology*	M																																
数字电子技术*   Digital Electronic Technology*		M																															

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																	
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	11.1	11.2	12.1	12.2		
自动控制原理*   The Principle of Automatic Control*			M		M						M																							
现代控制理论    Modern Control Theory				M		M					M																			M				
过程控制工程*    Process Control Engineering*				M							H		M																					
计算机控制技术*    Computer Control Technology*				M								H																						
过程建模技术*    Process Modeling Technology*		M				H						M																						
集散控制系统(DCS)    Distributed Control System												M				M																		
过程检测技术与传感器    Process Detection Techniques and Sensors				M								M																						
职业规划与就业指导    Career Planning and Employment Guidance																							L	M										
形势与政策   Current Situation and Policies									M														L							M				
大学生心理与健康教育   Mental and Health Education for College Students																								M										
军事理论    Military Theory																								M	L									
安全教育    Safety Education									M								M	L													M			
劳动教育    Labour Education																							M		M		M							
军训   military training																							M	M			M							
电路分析基础实验   Circuit Analysis Experiment						M																				M								

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	11.1	11.2	12.1	12.2	
生产实习   Production Practice																		L	M				L					M					M
毕业设计 (论文)    Graduation Design (or Thesis)							M		M				M			M				L								M		L			M
创造性思维与创新方法    Creative Thinking and Innovative Methods																												M				M	M
控制工程课程设计    Course Design of Control Engineering							M		M			L				M		L		M											M		
计算机控制系统集成设计   Integrated Design of Computer Control System														M													M				M		
工程实训   Engineering Practice													M			M										M							

# 计算机科学与技术学院





# 沈阳化工大学本科培养方案

## 计算机科学与技术学院

专业名称：计算机科学与技术

专业代码：080901

制 定：张 雪

审 核：张 波

审 定：于三三

批 准：金志浩

2021 年 8 月



# 计算机科学与技术专业培养方案

## 一、培养目标

本专业培养具有高尚的道德品质、良好的职业素养和社会责任感，适应辽宁经济建设和我国 IT 行业发展需求，为社会主义建设服务，能够运用数学、自然科学和计算机科学的基础知识，在计算机软件、大数据处理、物联网工程等相关领域从事技术研究、产品研发、应用开发和系统实施与维护工作，胜任企事业单位技术或管理骨干的有特色的高素质应用型人才。

本专业毕业生具有如下目标预测：

(1) 能在社会活动中，综合考虑社会、法律、安全、环境及可持续性等因素，体现高度的社会责任感和工程职业道德，具有服务社会的意愿和能力。

(2) 能够在企业和社会实际环境中，按照计算机工程技术规范将数学、自然科学与计算机科学的基础知识和技术运用于技术研究、产品研发、应用开发和系统实施与维护。

(3) 能够根据 IT 技术发展和社会发展需求，在计算机新产品、新技术等领域，具有研发精神和创新意识，具有积极寻求和获取新知识与新技术的能力。

(4) 能够在社会环境中，熟练运用外语与计算机相关工具，就软硬件系统开发、产品研发、新知识新技术等环节，与国内外同行进行有效沟通。

(5) 能在多角色人员构成的团队中，有效地发挥重要作用，进而从系统的视角管理多学科组成的项目。

## 二、专业方向

计算机科学与技术

## 三、毕业要求

计算机科学与技术专业对学生的毕业要求为 12 条，并对每一个毕业要求指标点进行分解，分别如下：

1.工程知识：掌握本专业所需的数学、自然科学知识和计算机学科知识，并能用于解决计算机软件、大数据处理、物联网工程等相关领域的复杂工程问题。

2.问题分析：能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究分析计算机软件、大数据处理、物联网工程等相关领域复杂工程问题，以获得有效结论。

3.设计/开发解决方案：能够设计针对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题的解决方案，设计满足特定需求的系统、单元（部件）或工艺流程，并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素。

4.研究：能够基于科学原理并采用科学方法对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。

5.使用现代工具：能够针对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题，开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具，包括对复杂计算机工程及其相关领域问题的预测与模拟，并能够理解其局限性。

6.工程与社会：能够基于计算机软件、大数据处理、物联网工程等相关领域相关背景知识进行合理分析，评价计算机专业工程实践和计算机软件、大数据处理、物联网工程等相关领域复杂工程解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。

7.环境和可持续发展：能够理解和评价针对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题的工程实践对环境、社会可持续发展的影响。

8.职业规范：具有人文社会科学素养、社会责任感，能够在工程实践中理解并遵守工程职业道德和规范，履行责任。

9.个人和团队：能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。

10.沟通：能够就计算机软件、大数据处理、物联网工程等相关领域复杂工程问题与业界同行及社会公众进行有效沟通和交流，包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。并具备一定的国际视野，能够在跨文化背景下进行沟通和交流。

11.项目管理：理解并掌握计算机软件、大数据处理、物联网工程等相关领域中工程管理原理与经济决策方法，并能在多学科环境中应用。

12.终身学习：具有自主学习和终身学习的意识，有不断学习和适应发展的能力。

毕业能力要求及其指标点分解：

毕业能力要求	指标点
<b>毕业要求 1：工程知识</b> 掌握本专业所需的数学、自然科学知识和计算机学科知识，并能用于解决计算机软件、大数据处理、物联网工程等相关领域的复杂工程问题	1-1. 掌握数学、自然科学和计算机学科的基础知识，用于表述实际问题的数学模型
	1-2. 掌握数学、自然科学和计算机学科的知识 and 原理，用于建立实际问题的数学模型
	1-3. 运用计算机学科的专业知识和原理，依据建立的数学模型，进行计算机软硬件系统的单元分析与设计
	1-4. 将计算机学科的专业知识和原理用于建立实际问题的解决方案
<b>毕业要求 2：问题分析</b> 能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究分析计算机软件、大数据处理、物联网工程等相关领域复杂工程问题，以获得有效结论	2-1. 能够运用数学、自然科学和专业 知识，识别和判断计算机软件、大数据处理、物联网工程等相关领域复杂工程问题
	2-2. 能够基于数学、自然科学和专业 知识，表达计算机软件、大数据处理、物联网工程等相关领域复杂工程问题
	2-3. 认识到解决问题有多种方案，寻求可替代的解决方案
	2-4. 通过文献研究，分析和筛选出计算机软件、大数据处理、物联网工程等相关领域复杂工程问题的解决方案
<b>毕业要求 3：设计解决方案</b> 能够设计针对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题的解决方案，设计满足特定需求的系统、单元（部件）或工艺流程，并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素	3-1. 掌握计算机软件、大数据处理、物联网工程等相关领域内工程设计和产品开发全周期、全流程的基本设计/开发方法和技术
	3-2. 能够针对计算机软件、大数据处理、物联网工程等相关领域内的特定需求，完成计算机软硬件系统单元的设计，并能在设计中体现创新意识
	3-3. 在设计中能够考虑安全、法律、文化以及环境等制约因素
<b>毕业要求 4：问题研究</b> 能够基于科学原理并采用科学方法对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论	4-1. 基于计算机科学原理，能够利用文献资料，针对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题建立相应研究模型，并符合系统开发和工程化的基本要求
	4-2. 针对研究模型，提出自己的研究思路和想法，设计出切实可行的模拟或实验方案
	4-3. 能够依据实验方案开展实验，对实验数据进行分析 and 解释、并通过信息综合得到合理有效的结论

<p>毕业要求 5: 使用现代工具</p> <p>能够针对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题, 开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具, 包括对复杂计算机工程及其相关领域问题的预测与模拟, 并能够理解其局限性</p>	5-1. 了解常用开发环境及开发工具的性能、适应范围以及对开发、分析的适应性, 并能正确应用
	5-2. 针对具体的对象, 能够选择并使用恰当的开发工具进行设计、计算和分析, 并能够理解其局限性
	5-3. 能够针对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题, 选用满足特定需求的现代工具, 模拟计算机及其相关领域的专业问题
<p>毕业要求 6: 工程与社会</p> <p>能够基于计算机软件、大数据处理、物联网工程等相关领域相关背景知识进行合理分析, 评价计算机专业工程实践和计算机软件、大数据处理、物联网工程等相关领域复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响, 并理解应承担的责任</p>	6-1. 了解与计算机软件、大数据处理、物联网工程等相关领域的法律、法规和产业政策, 并理解计算机工程实践对于社会、健康、安全、法律以及文化的可能影响
	6-2. 能够基于计算机科学与技术专业知识, 结合相关的应用背景知识, 评价计算机专业工程实践对于社会、安全、法律和文化的可能影响, 并理解应承担的责任
<p>毕业要求 7: 环境和可持续发展</p> <p>能够理解和评价针对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题的工程实践对环境、社会可持续发展的影响</p>	7-1. 具有环境保护的自觉和可持续发展的意识; 了解环境保护与可持续发展相关的方针与政策、法律与法规
	7-2. 能够理解实际解决方案和工程实践的可持续性, 理解和评价计算机软件、大数据处理、物联网工程等相关领域复杂工程问题的解决方案和计算机专业工程实践对环境、社会可持续发展的影响
<p>毕业要求 8: 职业规范</p> <p>具有人文社会科学素养、社会责任感, 能够在工程实践中理解并遵守工程职业道德和规范, 履行责任</p>	8-1. 具有基本的人文社会素养, 能够运用历史、哲学的知识和方法认识、分析社会现象, 树立和践行社会主义核心价值观, 理解个人与社会的关系, 了解中国国情, 明确个人作为社会主义事业建设者和接班人所肩负的责任和使命。
	8-2. 能够拥有健康的体质, 具有良好的心理素质和社会责任感
	8-3. 理解诚实守信的计算机软件、大数据处理、物联网工程等相关领域的工程职业道德和规范, 并能自觉遵守, 理解计算机软件、大数据处理、物联网工程等相关领域工程师对公众的社会责任
<p>毕业要求 9: 个人和团队</p> <p>能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色</p>	9-1. 在多学科背景下明确团队的角色构成和职责分工, 能够具有团队合作意识, 能够提出自己的想法并且倾听其他成员的意见和建议
	9-2. 能够与团队其他成员有效沟通, 能够在团队中承担个体、团队成员以及负责人的角色, 并完成团队分配的任务
<p>毕业要求 10: 沟通</p> <p>能够就计算机软件、大数据处理、物联网工程等相关领域复杂工程问题与业界同行及社会公众进行有效沟通和交流, 包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。并具备一定的国际视野, 能够在跨文化背景下进行沟通和交流</p>	10-1. 能够将计算机软件、大数据处理、物联网工程等相关领域复杂工程问题用文稿或图纸等技术文件进行清晰表达
	10-2. 能够通过文稿或图纸等技术文件利用现代信息技术与业界同行及社会公众就计算机软件、大数据处理、物联网工程等相关领域复杂工程问题进行沟通交流
	10-3. 了解计算机科学与技术专业相关行业的热点问题与国际状况
	10-4. 具备一门外国语的基本听、说、读、写、译能力, 能够阅读专业领域的外文资料, 能够在跨文化背景下进行沟通和交流
<p>毕业要求 11: 项目管理</p> <p>理解并掌握计算机软件、大数据处理、物联网工程等相关领域中工程管理原理与经济决策方法, 并能在多学科环境中应用</p>	11-1. 能够理解和掌握计算机工程的管理原理和经济决策方法
	11-2. 能够在解决计算机工程方案设计过程中, 运用工程管理和经济决策的方法
<p>毕业要求 12: 终身学习</p> <p>具有自主学习和终身学习的意识, 有不断学习和适应发展的能力</p>	12-1. 具有自主学习和终身学习意识
	12-2. 具有自主学习的能力, 包括对技术问题的理解能力、归纳总结的能力和解决问题的能力

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。

## 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标				
	培养目标 1	培养目标 2	培养目标 3	培养目标 4	培养目标 5
1: 工程知识		R			
2: 问题分析		R			
3: 设计/开发解决方案	R	R	R		
4: 研究		R	R		
5: 使用现代工具		R		R	
6: 工程与社会	R				
7: 环境和可持续发展	R				
8: 职业规范	R				
9: 个人和团队					R
10: 沟通				R	
11: 项目管理					R
12: 终身学习			R		

### 四、主干学科

计算机科学与技术

### 五、专业核心课程

C 语言程序设计 I、离散数学 I、离散数学 II、电路与电子技术基础、计算机组成原理、算法与数据结构、操作系统、计算机网络、面向对象程序设计、数据库系统原理、软件工程、数字逻辑、编译原理

### 六、修业年限

本科基本学制 4 年，弹性学习年限 3-6 年，按照学分管理制度管理。

### 七、授予学位

学生应至少修满 169 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者，可授予工学学士学位。

## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例(%)
通识教育课	通识教育必修课	思政类	必修	17	40	23.67
		外语类		12		
		经济管理类		1		
		军事安全类		2		
		劳动体育类		5		
		创新创业类		2		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	2	8	4.73
		中国与世界(500)		1		
		四史(600)		1		
		经济管理类(700)		1		
		科学技术类(800)		1		
		传统文化(900)		2		
通识教育实践课	军训	实践	2	2	1.18	
学科平台课	学科基础课程	数学与自然科学类	必修	51	73.5	70.41
		工程基础类				
		专业基础类				
学科实践课程	-	实践	22.5			
专业教育课	专业核心课程	-	必修	31	40.5	
	专业选修课程	-	选修	2		
	专业实践课程	-	实践	7.5		
能力拓展课	专业特色课程	-	实践	5	5	
课外环节	课外通识实践	人文社会实践	课外实践	4		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
生涯教育	成长规划类	1				
总学分/比例					169	100%

# Computer Science and Technology Major 2021 Undergraduate Education Program

## I. Educational Objectives

This major cultivates students with noble moral quality, good professional quality and sense of social responsibility, meets the needs of Liaoning economic construction and the development of China's IT industry, serves the socialist construction, and can use the basic knowledge of mathematics, natural science and computer science to engage in technical research, product research and development in computer software, big data processing, Internet of things engineering and other related fields Application development, system implementation and maintenance, and high-quality application-oriented talents who are competent for the technical or management backbone of enterprises and institutions.

Graduates should obtain knowledge and competences as follows:

(1) Be able to we can comprehensively consider social, legal, safety, environmental, sustainability and other factors in social activities, reflect a high sense of social responsibility and engineering professional ethics, and have the willingness and ability to serve the society.

(2) Be able to apply the basic knowledge and technology of mathematics, natural science and computer science to technical research, product R & D, application development and system implementation and maintenance in the enterprise and social actual environment according to the technical specifications of computer engineering.

(3) According to the IT technology development and social development needs, in the field of new computer products, new technology, with a certain research and development spirit and innovation consciousness, with the ability to actively seek and acquire new knowledge and new technology.

(4) Be able to skillfully use foreign language and computer related tools in the social environment, and effectively communicate with peers at home and abroad on software and hardware system development, product development, new knowledge and new technology, etc.

(5) Be able to effectively play an important role in the team composed of multi-role personnel, and then manage multi-disciplinary projects from a systematic perspective.

## II. Major direction

Computer science and technology

## III. Graduation Requirements

There are 12 graduation requirements for students majoring in computer science and technology.

1. Engineering Knowledge: master the knowledge of mathematics, natural science and computer required by the major, and be able to solve complex engineering problems in computer software, big data processing, Internet

of things engineering and other related fields.

2. Problem Analysis: be able to apply the basic principles of mathematics, natural science and engineering science to identify, express and analyze complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields through literature research, so as to obtain effective conclusions.

3. Design / Development Solutions: be able to design solutions for complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields, design systems, units (components) or technological processes to meet specific needs, and reflect the sense of innovation in the design process, considering social, health, safety, legal, cultural and environmental factors.

4. Research: be able to research complex engineering problems in computer software, big data processing, Internet of things and other related fields based on scientific principles and methods, including designing experiments, analyzing and interpreting data, and drawing reasonable and effective conclusions through information synthesis.

5. Use Tools: be able to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields, including the prediction and simulation of complex computer engineering and related fields, and understand their limitations.

6. Engineering and Society: be able to reasonably analyze the background knowledge of computer software, big data processing, Internet of things engineering and other related fields, and evaluate the impact of computer professional engineering practice and complex engineering problem solutions in computer software, big data processing, Internet of things engineering and other related fields on society, health, safety, law and culture, and understand the responsibility.

7. Environment and Sustainable Development: be able to understand and evaluate the impact of engineering practice on the environment and social sustainable development for complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields.

8. Career Planning: have humanities and social science literacy, sense of social responsibility, be able to understand and abide by engineering professional ethics and norms in engineering practice, and fulfill responsibilities.

9. Individual and Teams: be able to take on the role of individual, team member and leader in a multidisciplinary team.

10. Communicate: be able to effectively communicate with peers in the industry and the public on complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields, including writing reports and design manuscripts, making statements, clearly expressing or responding to instructions. And have a certain international vision, be able to communicate and exchange in the cross-cultural background.

11. Project Management: understand and master the engineering management principles and economic

decision-making methods in computer software, big data processing, Internet of things engineering and other related fields, and be able to apply them in a multidisciplinary environment.

12. Lifelong Learning: have the consciousness of autonomous learning and lifelong learning, and have the ability of continuous learning and adapting to development.

Graduates should obtain knowledge and competences as follows:

Graduation Requirements	Indices
<p>Requirement 1: Engineering Knowledge master the knowledge of mathematics, natural science and computer required by the major, and be able to solve complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields.</p>	1-1. Master the basic knowledge of mathematics, natural science and computer science, and use it to express the mathematical model of practical problems
	1-2. Master the knowledge and principles of mathematics, natural science and computer science, and use it to establish mathematical models for practical problems
	1-3. Using the professional knowledge and principles of computer science, according to the established mathematical model, carry out the unit analysis and design of computer software and hardware system
	1-4. Use the professional knowledge and principles of computer science to build solutions to practical problems
<p>Requirement 2: Problem Analysis be able to apply the basic principles of mathematics, natural science and engineering science to identify, express and analyze complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields through literature research, so as to obtain effective conclusions.</p>	2-1. Be able to use mathematics, natural science and professional knowledge to identify and judge complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields
	2-2. Be able to express complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields based on mathematics, natural science and professional knowledge
	2-3. Recognize that there are multiple solutions to the problem and seek alternative solutions
	2-4. Through literature research, the solutions of complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields are analyzed and screened
<p>Requirement 3: Design Solutions be able to design solutions for complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields, design systems, units (components) or technological processes to meet specific needs, and reflect the sense of innovation in the design process, considering social, health, safety, legal, cultural and environmental factors.</p>	3-1. Master the basic design / development methods and technologies of the whole cycle and process of engineering design and product development in computer software, big data processing, Internet of things engineering and other related fields
	3-2. According to the specific needs of computer software, big data processing, Internet of things engineering and other related fields, we can complete the design of computer software and hardware system unit, and reflect the sense of innovation in the design
	3-3. Safety, law, culture and environment can be considered in the design
<p>Requirement 4: Research be able to research complex engineering problems in computer software, big data processing, Internet of things and other related fields based on scientific principles and</p>	4-1. Based on the principle of computer science, graduates can use the literature to establish the corresponding research model for the complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields, and meet the basic requirements of system development and engineering



<p>methods, including designing experiments, analyzing and interpreting data, and getting reasonable and effective conclusions through information synthesis.</p>	4-2. Aiming at the research model, graduate can put forward his own research ideas and ideas, and designs a feasible simulation or experimental scheme
	4-3. Can carry out the experiment according to the experimental scheme, analyze and explain the experimental data, and get reasonable and effective conclusions through information synthesis
<p>Requirement 5: Use Modern Tools be able to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields, including the prediction and simulation of complex computer engineering and related fields, and understand their limitations.</p>	5-1. Understand the performance, scope of application, adaptability to development and analysis of common development environment and development tools, and be able to apply them correctly
	5-2. For specific objects, be able to select and use appropriate development tools for design, calculation and analysis, and understand their limitations
	5-3. Be able to select modern tools to meet specific needs and simulate professional problems in computer and related fields for complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields
<p>Requirement 6: Engineering and Society be able to reasonably analyze the background knowledge of computer software, big data processing, Internet of things engineering and other related fields, and evaluate the impact of computer professional engineering practice and complex engineering problem solutions in computer software, big data processing, Internet of things engineering and other related fields on society, health, safety, law and culture, And understand the responsibility.</p>	6-1. Understand laws, regulations and industrial policies related to computer software, big data processing, Internet of things engineering and other fields, and understand the possible impact of computer engineering practice on society, health, safety, law and culture
	6-2. Be able to evaluate the possible impact of computer engineering practice on society, security, law and culture based on the professional knowledge of computer science and technology and relevant application background knowledge, and understand the responsibilities to be undertaken
<p>Requirement 7: Environment and Sustainable Development be able to understand and evaluate the impact of engineering practice on the environment and social sustainable development for complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields.</p>	7-1. Have the consciousness of environmental protection and sustainable development; Understand the guidelines, policies, laws and regulations related to environmental protection and sustainable development
	7-2. Be able to understand the sustainability of practical solutions and engineering practice, understand and evaluate the solutions of complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields, and the impact of computer professional engineering practice on the sustainable development of environment and society
<p>Requirement 8: Career Planning have humanities and social science literacy, sense of social responsibility, be able to understand and abide by engineering professional ethics and norms in engineering practice, and fulfill responsibilities.</p>	8-1. Have basic humanistic and social literacy, be able to use historical and philosophical knowledge and methods to understand and analyze social phenomena, establish and practice core socialist values, understand the relationship between individuals and society, and understand China's national conditions, and make clear the responsibility and mission shouldered by the individual as the socialist builder and successor.
	8-2. To have a healthy physique, with the correct values, with good psychological quality and sense of social responsibility

	8-3. Understand the engineering professional ethics and norms in the fields of honest and trustworthy computer software, big data processing, Internet of things engineering, and consciously abide by and understand the social responsibility of engineers in computer software, big data processing, Internet of things engineering and other related fields to the public. Individuals and teams
Requirement 9: Individuals and Teams be able to take on the role of individual, team member and leader in a multidisciplinary team.	9-1. Be clear about the role composition and responsibility division of the team under the multi-disciplinary background, be able to have a sense of teamwork, be able to put forward their own ideas and listen to the opinions and suggestions of other members
	9-2. Be able to communicate with other team members effectively, take on the role of individual, team member and leader in the team, and complete the tasks assigned by the team
Requirement 10: Communicate be able to effectively communicate with peers in the industry and the public on complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields, including writing reports and design manuscripts, making statements, clearly expressing or responding to instructions. And have a certain international vision, be able to communicate and exchange in the cross-cultural background.	10-1. Be able to clearly express complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields with technical documents such as manuscripts or drawings
	10-2. Be able to use modern information technology to communicate with peers in the industry and the public on complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields through technical documents such as manuscripts or drawings
	10-3. Understand the hot issues and international situation of computer science and technology related industries
	10-4. Have basic listening, speaking, reading, writing and translation skills in a foreign language, be able to read foreign language materials in professional fields, and be able to communicate and communicate in a cross-cultural context
Requirement 11: Project Management understand and master the engineering management principles and economic decision-making methods in computer software, big data processing, Internet of things engineering and other related fields, and be able to apply them in a multidisciplinary environment.	11-1. Be able to understand and master the management principles and economic decision-making methods of computer engineering
	11-2. Be able to use the methods of engineering management and economic decision-making in the process of solving computer engineering scheme design
Requirement 12: Lifelong Learning have the consciousness of autonomous learning and lifelong learning, and have the ability of continuous learning and adapting to development.	12-1. Have the consciousness of autonomous learning and lifelong learning
	12-2. Have the ability of autonomous learning, including the ability to understand technical problems, the ability to summarize and solve problems

## The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives				
	Educational Objectives 1	Educational Objectives 2	Educational Objectives 3	Educational Objectives 4	Educational Objectives 5
1: Engineering Knowledge		√			
2: Problem Analysis		√			
3: Design/Development Solutions	√	√	√		
4: Research		√	√		
5: Use Modern Tools		√		√	
6: Engineering and Society	√				
7: Environment and Sustainable Development	√				
8: Career Planning	√				
9: Individuals and Teams					√
10: Communicate				√	
11: Project Management					√
12: Lifelong Learning			√		

Computer Science and Technology

### V. Core Courses

C language programming I, Discrete Mathematics I, Discrete Mathematics II, circuit and electronic technology foundation, computer composition principle, algorithm and data structure, operating system, computer network, object-oriented programming, database system principle, software engineering, digital logic, compilation principle

### VI. Educational System

The basic length of undergraduate education is 4 years, and the flexible study period is 3-6 years. It is managed according to the credit system.

### VII. Confer Degrees

Students should complete at least 169 credits before graduation. The Bachelor of engineering degree can be granted to those who meet the degree awarding requirements of the relevant regulations on the awarding of bachelor's degree for graduates of Shenyang University of Chemical Technology (revised in March 2017).

## VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit requirement	Subtotal	Proportion (%)
General Education	General Education (Compulsory)	Ideological and Political Courses	Compulsory	17	40	23.67
		Foreign Language Courses		12		
		Economic Management		1		
		Military and Safety Courses		2		
		Labor and Sport Education		5		
		Innovation and Entrepreneurship		2		
		Mental Health		1		
	General Education (Optional)	Aesthetic Education(400)	Optional	2	8	4.73
		China and the world(500)		1		
		Four Histories(600)		1		
		Economic Management(700)		1		
		Science and technology(800)		1		
		Traditional Culture(900)		2		
General Education (Practice)	Military Training	Practice	2	2	1.18	
Discipline Education	Basic Courses	Math and Science	Compulsory	51	73.5	70.41
		Engineering Foundation				
		Professional foundation				
Basic Practice Sessions	-	Practice	22.5			
Specialized Education	Core Courses	-	Compulsory	31	40.5	70.41
	Optional Courses	-	Optional	2		
	Specialized Practice Sessions	-	Practice	7.5		
Competency Development	Individualized Courses	-	Compulsory (or Practice)	5	5	
Extracurricular links	Extracurricular General Education Practice	Culture and Society Practice	Extracurricular Practice	4		
		Mentally and Physically Practice				
		Foreign Language Proficiency Training Practice				
	Extracurricular Characteristic Practice	Innovative Training		4		
		Innovation Competition				
		Chuangke activities				
	Career Education	Growth Planning Courses		1		
Total/Proportion					169	100%

## 九、计算机科学与技术专业教学进程表

### Table of Teaching Schedule for Computer Science and Technology Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
通识教育课 General Education	必修 Compulsory	思政类 Ideological and Political Courses	0710093001	思想道德与法治    Ideological Morality and the Rule of Law	3.0	48	32			16		2								
			0710053001	中国近现代史纲要    Outline of Chinese Contemporary and Modern History	3.0	48	32			16	2									
			0710103001	马克思主义基本原理*    Elementary Theory of Marxism*	3.0	48	32			16			2							
			0710123001	习近平新时代中国特色社会主义思想概论    Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8					3					
			0710133001	毛泽东思想和中国特色社会主义理论体系概论*    Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3.0	48	32			16				2						
			0710012301	形势与政策    Current Situation and Policies	2.0	64	64				1	1	1	1	1	1	1	1	1	
	外语类 Foreign Language Courses	0211003101	大学外语I    College English I	3.0	48					3										
		0211003201	大学外语II    College English II	3.0	48						3									





课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
						讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八			
										1st	2nd	3rd	4th	5th	6th	7th	8th			
	实践 Practice	0415102011	军训   military training	2.0	48				48	+2									集中	
合计 Total				50.0																
学科平台课 Discipline Education	必修 Compulsory	数学与自然科学类 Natural Science & Mathematics	0310004101	高等数学 I*   Advanced Mathematics I*	4.5	80	72			8	6									
			0310005201	高等数学 II*   Advanced Mathematics II*	5.5	96	88			8	6									
			0310063001	大学物理*   University Physics	3.0	48	48				3									
			0310034001	线性代数   Linear Algebra	4.0	64	64					4								
			0317184001	概率论与数理统计   Probability and Statistics	4.0	64	64						4							
			1617052002	离散数学 I*   Discrete Mathematics I*	2.5	40	40				3									
				1612012002	离散数学 II    Discrete Mathematics II	2.0	32	32				2								
		工程基础类 Foundation Engineering		1610052002	计算机科学导论   Introduction to Computer Science	2.0	32	32				2								
				1612021002	工程导论   Introduction to Engineering	1.0	16	16				2								
				1612051002	文献检索与科技论文写作   Document Retrieval and Scientific Paper Writing	1.0	18	12	6				2							
			1617012002	计算机学科专业外语   English for Computer Specialty	2.0	32	32								2					





课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
						讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八			
										1st	2nd	3rd	4th	5th	6th	7th	8th			
学科平台课 Discipline Education	实践 Practice	0310081011	大学物理实验   Physical experiment of college	1.0	24	6	18				2									
		1615351022	Java 语言实践    Practices for Java Language	1.5	36		36					2								
		1617201022	Linux 操作系统课程设计   Practice for Linux Operation System	1.0	24		24							2						
		1615461022	Python 语言课程设计   Python Programming course design	1.0	24			24							2					
		1615232032	生产实习   Production Practice	2.0			48												+2	
		1617031042	毕业设计（论文）   Graduation Design（Thesis）	14.0	336															+14
		小计 Subtotal				22.5	384.0	72.0	108.0	24.0	0.0	0.0	3.5	2.0	2.5	2.0	2.0	3.0	21.0	
合计 Total				72.5																
专业教育课 Specialized Education	必修 Compulsory	1610043102	C 语言程序设计 I*   C Programming Language I*	3.0	56	32		24		2										
		1617003002	电路与电子技术基础   The Circuit and Electronic Technology	3.0	56	32	24				2									
		1610083002	算法与数据结构*   Algorithm and Data Structures*	3.0	52	40		12				3								
		1610073002	面向对象程序设计*   Object-Oriented Programming*	3.0	56	32		24				2								
		1610243002	数字逻辑   Digital Logic	3.0	52	40	12					3								
		1610093002	计算机组成原理*   Computer Organization and Architecture*	3.0	52	40	12						3							

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
										1st	2nd	3rd	4th	5th	6th	7th	8th		
专业教育课 Specialized Education	必修 Compulsory	1610123002	数据库系统原理*   Principle of Database System*	3.0	52	40		12				3							
		1610112002	编译原理*   Compiler Construction Principles*	2.5	44	32		12				2							
		1610142002	计算机网络*   Computer Networking*	2.5	44	32		12				2							
		1614332002	操作系统   Operating System	2.5	40	40						3							
		1610152002	软件工程   Software Engineering	2.5	40	40						3							
		小计 Subtotal			31.0	544.0	400.0	48.0	96.0	0.0	2.0	2.0	7.0	7.0	7.0	0.0	0.0	0.0	
	选修 Optional	0330103001	普通物理   General Physics	3.0	48	48						3							
		1630893002	网络工程技术竞赛   Network Engineering Technology Competition	3.0	64	16	48							2					
		1633532002	数据挖掘   Data Mining	2.0	36	24		12						2					
		1630752202	程序设计竞赛II   Programming Competition	2.5	48	24		24						2					
		1637993002	人工智能系统设计   Artificial intelligence system design	3	56	32		24						2					
		1637102002	移动应用开发技术   Android & Application Development	2	36	24	12							2					
		1637972002	Oracle 数据库   Oracle Database	2.5	48	24		24						2					

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes			
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八				
										1st	2nd	3rd	4th	5th	6th	7th	8th				
专业教育课 Specialized Education	选修 Optional	1637093002	单片机原理及接口技术   SCM Principles and Interface Technology	3.5	64	32		32					2								
		1637213002	嵌入式微处理器结构与应用   Structure and Application of Embedded Microprocessor	3.0	52	40		12							3						
		1637223002	算法设计与分析   Algorithm Design and Analysis	3.0	52	40		12							3						
		1633202002	安全协议设计与分析   Design and Analysis of Security Protocol	2.0	32	32										2					
		1633322002	信息安全    Information Safety	2.0	32	32										2					
		1637983002	人工智能与工业物联网   Artificial intelligence algorithm and Industrial Internet of things	3.0	56	32		24								2					
		1630432002	数字信号处理   Digital Signal Processing	2.5	44	32		12								2					
		1630512002	多媒体技术与应用   Multimedia Technology and Application	2.0	32	32											2				
		1630343002	计算机控制技术   Computer Control Technology	3.0	56	32		24									2				
		1632881002	UML 与系统分析设计   UML and System Analysis and Design	1.5	28	16		12									2				
		1632892002	大数据存储技术   Big Data Storage Technology	2.0	40	16		24									2				
		1632862002	图形图像处理   Image Processing	2.0	32	32											2				
		1632852002	Matlab 导论   Introduction to Matlab	2.0	32	32											2				

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
										1st	2nd	3rd	4th	5th	6th	7th	8th		
专业教育课 Specialized Education	选修 Optional	1632832002	数学竞赛   Mathematics Competition	2.0	32	32										2			
		1632842002	专业技术竞赛   Professional Technology Competition	2.0	32	32										2			
		小计 Subtotal		2.0	1012	688	60	260	0	0	0	3	0	13	23	4	0		
	(专业选修学分必须修满2学分以上 Professional elective credits must be more than 2 credits)																		
	实践 Practice	1612041022	电子工程设计   Electronic Engineering Design	1.0			24					2							
		1615132022	计算机软件实训   Computer Software Training	2.0			48						3						
		1617121022	计算机组成原理课程设计   The Course Design of the Principle of Computer Composition	1.5	36									3					
		1613751022	软件工程实践   Practice for Software Engineering	1.0	24		24							2					
		1617131022	计算机网络课程设计   Computer Network Course Design	1.0	24										2				
		1617151022	大数据应用实践   Big Data Application Practice	1.0	24		24									2			CDIO 课程
	小计 Subtotal		7.5	84.0	24.0	24.0	72.0	0.0	0.0	0.0	2.0	0.0	7.0	4.0	0.0	0.0			
	合计 Total				40.5	1640.0	1112	132.0	428.0	0.0	2.0	2.0	12.0	7.0	26.5	27.0	4.0	0.0	
	能力拓展课 Competency Development	必修或实践 Compulsory or Practice	1617045022	学科特色实践   Discipline Characteristic Practice	5	120			120								12		
(本模块为必修实践环节 This module is a required practice)																			
总计 Sum				169.0						24.5	26	25.5	25.5	23.5	20	8	16		

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八	
											1st	2nd	3rd	4th	5th	6th	7th	8th	
课外环节 Extracurricular practice	课外实践 Extracurricular practice	人文社会实践 Culture and Society Practice	1614010012	社会调查   Social Survey	0.5	12				12								0.5	分散
		身心健康社会实践 Mentally and Physically Practice	0410050751	课外体育锻炼   Extracurricular Physical Exercise	0.5	12				12								0.5	分散
			2640030011	劳动教育实践   Labour Education Practice	0.5	12				12		0.5							分散
			0510070311	心理健康辅导   Mental Health Counseling	0.5	12				12							0.5		分散
		外语技能实践类 Foreign Language Proficiency Training Practice	0210010011	外语技能实践（初级）   Foreign Language Proficiency Training Practice (elementary)	2.0	48				48				2					二选一
			0210020011	外语技能实践（高级）   Foreign Language Proficiency Training Practice (advanced)	2.0	48				48				2					
		成长规划实践 Growth Planning Courses	1617601301	职业规划与就业指导   Career Planning and Employment Guidance	1.0	40	40				1						1		
能力与创新实践 Capability and Innovation Practice	1615494011	大学生素质拓展与创新实践   Quality Development and Innovation Practice	4.0	96				96	1~8 学期依据《沈阳化工大学创新创业实践学分认定办法》由创新创业学院认定								分散		
小计 Subtotal																			

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5,课程名称中画\*为考试课。

## 十、计算机科学与技术专业学士学位课程一览表

### A list of bachelor's degree programs in Computer Science

课程类别 Course Type	模块名称 Modules	序号 No.	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课 学期 Semester
通识教育课 General Education	思政类 Ideological and Political Courses	1	0710103001	马克思主义基本原理 Elementary Theory of Marxism*	3.0	3
		2	0710133001	毛泽东思想和中国特色社会主义 理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3	4
学科平台课 Discipline Education	数学 Mathematics	3	0310004101	高等数学I Advanced Mathematics I*	4.5	1
		4	0310005201	高等数学II Advanced Mathematics II*	5.5	2
		5	1617052002	离散数学 I Discrete Mathematics I*	3.0	1
	专业基础 Subject Foundation Requisite	6	1617072002	计算机体系结构 Computer Architecture	2.5	1
		7	1610992002	Java 语言程序设计 Java Language Programming	3.0	3
专业教育课 Specialized Education	必修 Compulsory	8	1610043102	C 语言程序设计 I C Programming Language I*	3.0	3
		9	1610073002	面向对象程序设计 Object-Oriented Programming*	3.0	4
		10	1610083002	算法与数据结构 Algorithm and Data Structures*	3.0	4
		11	1610093002	计算机组成原理 Computer Organization and Architecture*	2.5	5
		12	1610123002	数据库系统原理 Principle of Database System*	2.5	5
		13	1610142002	计算机网络 Computer Networking*	2.5	5
		14	1614332002	操作系统 Operating System	2.5	4
		15	1610152002	软件工程 Software Engineering	2.5	6

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》

### 十一、全学程实践环节周历安排 Weekly Calendar of all Practice Sessions

学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注
一		☆	☆															::	::	·		
二																		::	::	·		
三																		::	::	·		
四																		::	::	·		
五																		::	::	·		
六																		::	::	·		
七	P	P	P	P	P	P	/	/										::	::	·		
八	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=					

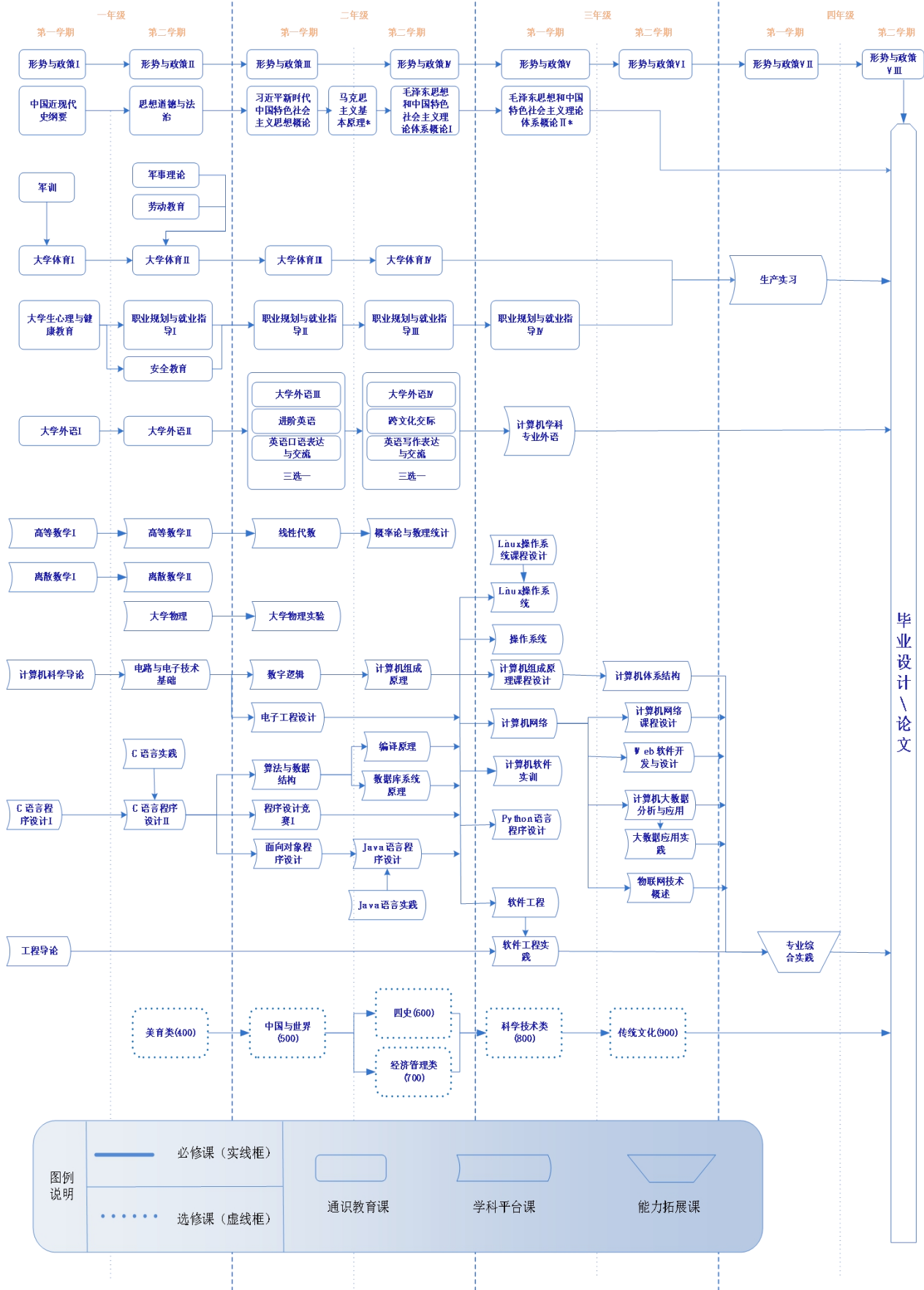
1026

符号说明(Symbol Description):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P 各类实训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼ 认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计(论文)||Graduation Project(Thesis)    ·小学期||Primary Ter



## 十二、课程体系配置图 Curriculum System Configuration Diagram





### 十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements (High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																			
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	12.2	
马克思主义基本原理*   Elementary Theory of Marxism*																						L	H													
中国近现代史纲要   Outline of Chinese Contemporary and Modern History																							H													
思想道德与法治    Ideological Morality and the Rule of Law																					H		H	H	H											
习近平新时代中国特色社会主义思想概论   Introduction to XiJinping Thought on Socialism with Chinese Characteristics for a New Era																						M	H													
毛泽东思想和中国特色社会主义理论体系概论   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics																						M	H													
大学外语I-IV   College English I-IV																												H		H						H
大学体育I-IV   College Physical EducationI-IV																											M									H
高等数学 I*、II*   Advanced Mathematics I*、II*	H	H	M	M																																

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																				
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	12.2		
线性代数   Linear Algebra		H				M																															
大学物理*   University Physics	H		H																																		
概率论与数理统计   Probability and Statistics		H			M	M																															
离散数学 I*   Discrete Mathematics I*	H				H																																
离散数学 II    Discrete Mathematics II		M			M	H																															
C 语言程序设计 I*   C Programming Language I*	H														H																						
电路与电子技术基础   The Circuit and Electronic Technology		M			H																																
算法与数据结构*   Algorithm and Data Structures*		H	M			H							H																								
计算机组成原理*   Computer Organization and Architecture*				H	M								H																								
编译原理*   Compiler Construction Principles*			H				H																														
操作系统   Operating System				H	H			L					H																								
计算机网络*   Principle of Database System*				H									H							M																	
数据库系统原理*   Principle of Database System*			M			H																															
软件工程   Software Engineering							H		H		H										H		H												H		







课程 (Courses)	毕业能力要求 (Graduation Requirements)																																					
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	12.2			
学科特色实践   Discipline Characteristic Practice								H			M		M	H													H		H								H	
毕业设计 (论文)   Graduation Design							M	H			M		M	H		H					H											H	H			H		H



# 沈阳化工大学本科培养方案

## 计算机科学与技术学院

专业名称：软件工程

专业代码：080902

制 定：郑秀红

审 核：张 波

审 定：于三三

批 准：金志浩

2021 年 8 月

# 软件工程专业培养方案

## 一、培养目标

本专业培养软件工程领域的高素质应用型软件工程师，他们具有良好的综合素质及创新意识，具有扎实的数学和自然科学基础知识，掌握计算机科学领域基础理论知识。能够利用深入的软件设计理论、先进的软件开发技术和现代软件工程规范进行应用型复杂软件系统的设计、开发、测试、项目管理等工作；在工作中，能通过不断学习进行自我提高，以适应软件行业的不断发展；在软件项目开发中，能利用外语、软件表达工具等进行交流与沟通，能与团队成员合作，表现出道德品质、职业素养和责任感；在项目管理与开发中能考虑软件系统对社会的影响。

本专业毕业生具有如下目标预测：

- (1) 具有较高的人文素质修养和科学研究素养，具有工程素养和创新意识。
- (2) 掌握数学、自然科学、计算机科学、和计算机软件领域的基础理论知识，并能在复杂工程问题的解决过程中合理运用。
- (3) 具备复杂软件系统方案的设计与实现能力，并能在一个团队中有效地发挥重要作用，或者担任一个团队的领导责任。
- (4) 具备自学和获取知识的能力；具备较强的知识更新能力。
- (5) 能在计算机领域、软件工程领域从事计算机教学、软件产品研发及软件产品测试的工作。

## 二、专业方向

软件工程

## 三、毕业要求

本专业要求学生掌握计算机和软件工程等方面的基础理论和基本知识，主要学习与研究软件开发和测试的基本原理与实现大型软件开发的工程技术，具有对新的软件设计、对算法的优化，改造的基本能力，能从事本学科及相邻交叉学科的创新工作。

毕业能力要求及其指标点分解：

毕业能力要求	指标点
毕业要求 1： 工程知识：掌握本专业所需的数学、自然科学知识和计算机学科知识，并能用于解决计算机软件、软件工程等相关领域的复杂工程问题。	1-1 掌握数学、自然科学和计算机学科的基础知识，用于表述实际问题的数学模型；
	1-2 掌握数学、自然科学和计算机学科的原理，用于建立实际问题的数学模型；
	1-3 运用计算机学科的专业知识和原理，依据建立的数学模型，进行计算机软件模块分析与设计；
	1-4 将计算机学科的专业知识和原理用于建立实际问题的解决方案；
毕业要求 2： 问题分析：能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究分析计算机软件、软件工程等相关领域复杂工程问题，以获得有效结论。	2-1 能够运用数学、自然科学和专业原理，识别和判断计算机软件、软件工程等相关领域复杂工程问题；
	2-2 能够基于数学、自然科学和专业原理，表达计算机软件、软件工程等相关领域复杂工程问题；
	2-3 能够认识到解决问题有多种方案，寻求可替代的解决方案；
	2-4 通过文献研究，分析和筛选出计算机软件、软件工程等相关领域复杂工程问题的解决方案；

<p>毕业要求 3:</p> <p>设计/开发解决方案: 能够设计针对计算机软件、软件工程等相关领域复杂工程问题的解决方案, 设计满足特定需求的软件系统、构件或项目开发流程, 并能够在设计环节中体现创新意识, 考虑社会、健康、安全、法律、文化以及环境等因素。</p>	3-1 掌握计算机软件、软件工程等相关领域内工程设计和系统开发全周期、全流程的基本设计/开发方法和技术;
	3-2 能够针对计算机软件、软件工程等相关领域内的特定需求, 完成计算机软件系统构件的设计, 并能够在设计中体现创新意识;
	3-3 在设计中能够考虑安全、法律、文化以及环境等制约因素;
<p>毕业要求 4:</p> <p>研究: 能够基于科学原理并采用科学方法对计算机软件、软件工程等相关领域复杂工程问题进行研究, 包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。</p>	4-1 基于计算机科学原理, 能够利用文献资料, 针对计算机软件、软件工程等相关领域复杂工程问题建立相应研究模型, 并符合系统开发和工程化的基本要求;
	4-2 针对研究模型, 提出自己的研究思路 and 想法, 设计出切实可行的模拟或实验方案;
	4-3 能够依据实验方案开展实验, 对实验数据进行分析和解释、并通过信息综合得到合理有效的结论。
<p>毕业要求 5:</p> <p>使用现代工具: 能够针对计算机软件、软件工程等相关领域复杂工程问题, 开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具, 包括对复杂软件工程及其相关领域问题的预测与模拟, 并能够理解其局限性。</p>	5-1 了解常用开发环境及开发工具的性能、适应范围以及对开发、分析的适应性, 并能正确应用;
	5-2 针对具体的对象, 能够选择并使用恰当的开发工具进行设计、计算和分析, 并能够理解其局限性;
	5-3 能够针对计算机软件、软件工程等相关领域复杂工程问题, 选用满足特定需求的现代工具, 模拟计算机及其相关领域的专业问题。
<p>毕业要求 6:</p> <p>工程与社会: 能够基于计算机软件、软件工程等相关领域相关背景知识进行合理分析, 评价软件工程专业工程实践和计算机软件、软件工程等相关领域复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响, 并理解应承担的责任。</p>	6-1 能够了解软件工程专业领域工程实训需要具备的相关能力;
	6-2 了解计算机软件、软件工程等相关领域相关背景知识和技术标准体系; 了解与计算机软件、软件工程等相关领域相关的法律、法规和产业政策;
	6-3 能够评价软件工程专业工程实践对于社会、安全、法律和文化的可能影响, 并理解应承担的责任。
<p>毕业要求 7:</p> <p>环境和可持续发展: 能够理解和评价针对计算机软件、软件工程等相关领域复杂工程问题的工程实践对环境、社会可持续发展的影响。</p>	7-1 具有环境保护的自觉和可持续发展的意识; 了解环境保护与可持续发展相关的方针与政策、法律与法规;
	7-2 能够理解实际解决方案和工程实践的可持续性, 理解和评价计算机软件、软件工程等相关领域复杂工程问题的解决方案和软件工程专业工程实践对环境、社会可持续发展的影响。
<p>毕业要求 8:</p> <p>职业规范: 具有人文社会科学素养、社会责任感, 能够在工程实践中理解并遵守工程职业道德和规范, 履行责任。</p>	8-1 具有基本的人文社会素养, 能够运用历史、哲学的知识和方法认识、分析社会现象, 理解个人与社会的关系, 了解中国国情;
	8-2 能够拥有健康的体质, 具有正确的价值观, 具有良好的心理素质和社会责任感;
	8-3 理解诚实公正、诚实守信的计算机软件、软件工程等相关领域的工程职业道德和规范, 并能自觉遵守, 理解计算机软件、软件工程等相关领域工程师对公众的社会责任。
<p>毕业要求 9:</p> <p>个人和团队: 能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。</p>	9-1 在多学科背景下明确团队的角色构成和职责分工, 能够具有团队合作意识, 能够提出自己的想法并且倾听其他成员的意见和建议;
	9-2 能够与团队其他成员有效沟通, 能够在团队中承担个体、团队成员以及负责人的角色, 并完成团队分配的任务。
<p>毕业要求 10:</p> <p>沟通: 能够就计算机软件、软件工程等相关领</p>	10-1 能够将计算机软件、软件工程等相关领域复杂工程问题用文稿或图纸等技术文件进行清晰表达;

域复杂工程问题与业界同行及社会公众进行有效沟通和交流，包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。并具备一定的国际视野，能够在跨文化背景下进行沟通和交流。	10-2 能够通过文稿或图纸等技术文件利用现代信息技术与业界同行及社会公众就计算机软件、软件工程等相关领域复杂工程问题进行沟通交流；
	10-3 了解软件工程专业相关行业的热点问题与国际状况；
	10-4 具备一门外语的听说读写译能力，能够阅读专业领域的外文资料，能够在跨文化背景下与同行进行交流。
毕业要求 11： 项目管理：理解并掌握计算机软件、软件工程相关领域中工程管理原理与经济决策方法，并能在多学科环境中应用。	11-1 能够理解和掌握软件工程管理原理和经济决策方法；
	11-2 能够在解决软件工程方案设计过程中，运用工程管理和经济决策的方法。
毕业要求 12： 终身学习：具有自主学习和终身学习的意识，有不断学习和适应发展的能力。	12-1 具有自主学习和终身学习意识；
	12-2 具有自主学习的能力，包括对技术问题的理解能力、归纳总结的能力和解决问题的能力。

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。

### 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标				
	培养目标 1	培养目标 2	培养目标 3	培养目标 4	培养目标 5
1: 工程知识		√			
2: 问题分析		√			
4: 研究		√	√		
5: 使用现代工具		√	√		
6: 工程与社会	√		√		
7: 环境和可持续发展	√				
8: 职业规范	√			√	√
9: 个人和团队			√		√
10: 沟通			√	√	√
11: 项目管理					√
12: 终身学习				√	

#### 四、主干学科

软件工程

#### 五、专业核心课程

C 语言程序设计I、面向对象程序设计、离散数学、算法与数据结构、操作系统、数据库原理、编译原理、计算机网络、计算机组成原理、软件工程、软件质量保障和项目管理、UML 与系统分析设计。

#### 六、修业年限

本科基本学制 4 年，弹性学习年限 3-6 年，按照学分管理制度管理。

## 七、授予学位

学生应至少修满 169 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者，可授予工学学士学位。

## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例 (%)
通识教育课	通识教育必修课	思政类	必修	17	39	23.08
		外语类		12		
		军事安全类		2		
		劳动体育类		5		
		创新创业类		2		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	1	8	4.73
		中国与世界(500)		1		
		四史(600)		1		
		经济管理类(700)		1		
		科学技术类(800)		2		
		传统文化(900)		2		
通识教育实践课	军训	实践	2	2	1.18	
学科平台课	学科基础课程	公共基础类	必修	60.5	66.5	39.34
		专业基础类				
	学科实践课程	-	实践	6		
专业教育课	专业核心课程	-	必修	25	48.5	28.70
	专业选修课程	-	选修	2		
	专业实践课程	-	实践	21.5		
能力拓展课	专业特色课程	-	必修(或实践)	5	5	2.96
课外环节	课外通识实践	人文社会实践	课外实践	4		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
生涯教育	成长规划类		1			
总学分/比例					169	100%

# Software Engineering Major 2021 Undergraduate Education Program

## I. Educational Objectives

This major cultivates application-oriented software engineers in the field of software engineering, who have good comprehensive quality and innovative consciousness, solid basic knowledge of mathematics and natural science, and master basic theoretical knowledge in the field of computer science. They can design, develop, test and manage application-oriented complex software system by using in-depth software design theory, advanced software development technology and modern software engineering specifications; In the work, they can improve themselves through continuous learning to adapt to the continuous development of the software industry; In software project development, they can use foreign languages, software expression tools for communication and cooperate with team members, showing moral character, professionalism and sense of responsibility; In project management and development, They can consider the impact of software system on society.

Graduates should obtain knowledge and competences as follows:

(1) Have high humanistic quality and scientific research quality, engineering quality and innovation consciousness.

(2) Master the basic theoretical knowledge in the fields of mathematics, natural science, computer science, and software engineering, and be able to use it reasonably in the process of solving complex engineering problems.

(3) Have the ability to design and implement complex software system solutions, and can effectively play an important role in a team, or take the leadership responsibility of a team.

(4) Have the ability of self-study and knowledge acquisition; have strong ability to update knowledge

(5) Have the ability to engage in computer teaching, software development and software product testing in the field of computer and software engineering.

## II. Major direction

Software Engineering

## III. Graduation Requirements

This major requires students to master the basic theory and knowledge of computer and software engineering. Students mainly study and research the basic principles of software development and testing and the engineering technology of large-scale software development, have the basic ability of new software design, algorithm optimization and transformation, and be able to engage in the innovation work of this discipline and adjacent interdisciplinary.

Graduates should obtain knowledge and competences as follows:

Graduation Requirements	Indices
<p>Requirement 1: Engineering knowledge: master the knowledge of mathematics, natural science and computer science; be able to solve complex engineering problems in computer software, software engineering and other related fields.</p>	1-1. Master the basic knowledge of mathematics, natural science and computer science, and use it to express the mathematical model of practical problems;
	1-2. Master the knowledge and principles of mathematics, natural science and computer science, and use them to establish mathematical models of practical problems;
	1-3. Use the professional knowledge and principles of computer science, according to the established mathematical model, analyze and design the computer software component;
	1-4 Use the professional knowledge and principles of computer science to build solutions to practical problems;
<p>Requirement 2: Problem analysis: be able to apply the basic principles of mathematics, natural science and engineering science to identify, express and analyze complex engineering problems in computer software, software engineering and other related fields through literature research, so as to obtain effective conclusions.</p>	2-1. Be able to use mathematics, natural science and professional knowledge to identify and judge complex engineering problems in computer software, software engineering and other related fields;
	2-2. Be able to express complex engineering problems in computer software, software engineering and other related fields based on mathematics, natural science and professional knowledge;
	2-3. Be able to recognize that there are many solutions to problems and seek alternative solutions;
	2-4. Through literature research, analyze and screen out solutions to complex engineering problems in computer software, software engineering and other related fields;
<p>Requirement 3: Design / development solutions: be able to design solutions to complex engineering problems in computer software, software engineering and other related fields, design software systems, components or project development processes to meet specific needs, and be able to reflect the sense of innovation in the design process, taking into account social, health, safety, legal, cultural and environmental factors.</p>	3-1. Master the basic design / development methods and technologies of the whole cycle and process of engineering design and system development in computer software, software engineering and other related fields;
	3-2. Be able to complete the design of computer software system components according to the specific needs of computer software, software engineering and other related fields, and embody the sense of innovation in the design;
	3-3. In the design, safety, law, culture, environment and other constraints can be considered;
<p>Requirement 4: Research: be able to study complex engineering problems in computer software, software engineering and other related fields based on scientific principles and scientific methods, including designing experiments, analyzing and interpreting data, and getting reasonable and effective conclusions through information synthesis.</p>	4-1. Based on the principles of computer science, be able to use literature to establish corresponding research models for complex engineering problems in computer software, software engineering and other related fields meet the basic requirements of system development and engineering;
	4-2. According to the research model, put forward their own research ideas, and design a practical simulation or experimental scheme;
	4-3. Be able to carry out experiments according to the experimental scheme, analyze and interpret the experimental data, and get reasonable and effective conclusions through information synthesis.



<p>Requirement 5:</p> <p>Using modern tools: be able to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for complex engineering problems in computer software, software engineering and other related fields, including prediction and simulation of complex software engineering and related fields understand their limitations.</p>	<p>5-1. Understand the performance and adaptability of common development environment and development tools, as well as their adaptability to development and analysis, and be able to apply them correctly;</p>
	<p>5-2. Be able to select and use appropriate development tools to design, calculate and analyze specific objects, and understand their limitations;</p>
	<p>5-3. Be able to select modern tools to meet specific needs and simulate professional problems in computer and related fields for complex engineering problems in computer software, software engineering and other related fields.</p>
<p>Requirement 6:</p> <p>Engineering and society: be able to make reasonable analysis based on the relevant background knowledge of computer software, software engineering and other related fields, evaluate the impact of software engineering professional engineering practice and complex engineering problem solutions in computer software, software engineering and other related fields on society, health, safety, law and culture, and understand the responsibilities.</p>	<p>6-1. Be able to understand the relevant abilities required for engineering training in the field of software engineering;</p>
	<p>6-2. Understand the background knowledge and technical standard system of computer software, software engineering and other related fields; Understand the laws, regulations and industrial policies related to computer software and software engineering;</p>
	<p>6-3. Be able to evaluate the possible impact of software engineering practice on society, safety, law and culture understand the responsibilities.</p>
<p>Requirement 7:</p> <p>Environment and sustainable development: be able to understand and evaluate the impact of engineering practice aiming at complex engineering problems in computer software, software engineering and other related fields on environment and social sustainable development.</p>	<p>7-1. Have the consciousness of environmental protection and sustainable development; Understand the guidelines and policies, laws and regulations related to environmental protection and sustainable development;</p>
	<p>7-2. Be able to understand the sustainability of practical solutions and engineering practice, understand and evaluate the solutions of complex engineering problems in computer software, software engineering and other related fields, and the impact of software engineering professional engineering practice on the sustainable development of environment and society.</p>
<p>Requirement 8:</p> <p>Professional norms: have humanities and social science literacy, sense of social responsibility, be able to understand and abide by engineering professional ethics and norms in engineering practice fulfill responsibilities.</p>	<p>8-1. Have basic humanistic and social literacy, be able to use historical and philosophical knowledge and methods to understand and analyze social phenomena, understand the relationship between individuals and society, and understand China national conditions;</p>
	<p>8-2. Be able to have healthy constitution, correct values, good psychological quality and sense of social responsibility;</p>
	<p>8-3. Understand the honest, fair, honest and trustworthy professional ethics and norms, and consciously abide by it, and understand the social responsibility of engineers in computer software, software engineering and other related fields to the public.</p>
<p>Requirement 9:</p> <p>Individual and team: be able to play the role of individual, team member and leader in a multidisciplinary team.</p>	<p>9-1. Be clear about the role composition and responsibility division of the team under the multi-disciplinary background, have the sense of teamwork, be able to put forward their own ideas and listen to the opinions and suggestions of other members;</p>
	<p>9-2. Be able to communicate with other team members effectively, take on the role of individual, team member and leader in the team, and complete the tasks</p>

	assigned by the team.
Requirement 10: Communication: be able to effectively communicate with peers and the public on complex engineering problems in computer software, software engineering and other related fields, including writing reports and design manuscripts, making statements, clearly expressing or responding to instructions. And have a certain international vision, be able to communicate and exchange in the cross-cultural background.	10-1. Be able to clearly express complex engineering problems in computer software, software engineering and other related fields with technical documents such as manuscripts or drawings;
	10-2. Be able to use modern information technology to communicate with peers in the industry and the public on complex engineering problems in computer software, software engineering and other related fields through manuscripts, drawings and other technical documents;
	10-3. Understand the hot issues and international situation of software engineering related industries;
	10-4. Have the basic ability of listening, speaking, reading, writing and translating in a foreign language, be able to read foreign materials in the field of software engineering, have a certain international vision, and be able to communicate and exchange under the cross-cultural background.
Requirement 11: Project management: understand and master the principles of project management and economic decision-making methods in the fields of computer software and software engineering, and be able to apply them in a multidisciplinary environment.	11-1. Be able to understand and master the management principles and economic decision-making methods of software engineering;
	11-2. Be able to use the methods of engineering management and economic decision-making in the process of software engineering solution design.
Requirement 12: Lifelong learning: have the consciousness of self-learning and lifelong learning, have the ability of continuous learning and adapting to development.	12-1. Have the consciousness of self-learning and lifelong learning;
	12-2. Have the ability of autonomous learning, including the ability to understand technical problems, the ability to summarize and solve problems.

### The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives				
	Educational Objectives 1	Educational Objectives 2	Educational Objectives 3	Educational Objectives 4	Educational Objectives 5
1: Engineering Knowledge		√			
2: Problem Analysis		√			
3: Design/Development Solutions	√	√	√		√
4: Research		√	√		
5: Use Modern Tools		√	√		
6: Engineering and Society	√		√		
7: Environment and Sustainable Development	√				
8: Career Planning	√			√	√
9: Individuals and Teams			√		√
10: Communication			√	√	√
11: Project Management					√
12: Lifelong Learning				√	

#### **IV. Major Subject**

Software Engineering

#### **V. Core Courses**

C Programming Language I, Object-Oriented Programming, Algorithm and Data Structures, Operating System, Principle of Database System, Compiler Construction Principles, Computer Networking, Computer Organization and Architecture, Software Engineering, Software Quality Assurance and Project Management, UML and System Analysis and Design Techniques

#### **VI. Educational System**

The basic length of undergraduate education is 4 years, and the flexible study period is 3-6 years. It is managed according to the credit system.

#### **VII .Confer Degrees**

Students should complete at least 169 credits before graduation. The Bachelor of engineering degree can be granted to those who meet the degree awarding requirements of the relevant regulations on the awarding of bachelors degree for graduates of Shenyang University of Chemical Technology (revised in March 2017).

## VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit requirement	Subtotal	Proportion (%)
General Education	General Education (Compulsory)	Ideological and Political Courses	Compulsory	17	39	23.08
		Foreign Language Courses		12		
		Military and Safety Courses		2		
		Labor and Sport Education		5		
		Innovation and Entrepreneurship		2		
		Mental Health		1		
	General Education (Optional)	Aesthetic Education(400)	Optional	1	8	4.73
		China and the World(500)		1		
		Four Histories(600)		1		
		Economic Management(700)		1		
		Science and Technology(800)		2		
		Traditional Culture(900)		2		
	General Education Practice	Military Training	Practice	2	2	1.18
Discipline Education	Basic Courses	Public Basic Class	Compulsory	60.5	66.5	39.34
		Professional foundation				
	Basic Practice Sessions	-	Practice	6		
Specialized Education	Core Courses	-	Compulsory	25	48.5	28.70
	Optional Courses	-	Optional	2		
	Specialized Practice Sessions	-	Practice	21.5		
Competency Development	Individualized Courses	-	Compulsory (or Practice)	5	5	2.96
Extracurricular links	Extracurricular General Education Practice	Culture and Society Practice	Extracurricular Practice	4		
		Mentally and Physically Practice				
		Foreign Language Proficiency Training Practice				
	Extracurricular Characteristic Practice	Innovative Training		4		
		Innovation Competition				
		Chuangke Activities				
	Career Education	Growth Planning Courses		1		
Total/Proportion					169	100%

九、软件工程专业教学进程表

Table of Teaching Schedule for Software Engineering Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
通识教育课 General Education	必修 Compulsory	思政类 Ideological and Political Courses	0710093001	思想道德与法治    Ideological Morality and the Rule of Law	3.0	48	32			16		2								
			0710053001	中国近现代史纲要   Outline of Chinese Contemporary and Modern History	3.0	48	32			16	2									
			0710103001	马克思主义基本原理*   Basic Principles of Marxism*	3.0	48	32			16			2							
			0710123001	习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8					3					
			0710133001	毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3.0	48	32			16				2						
			0710012301	形势与政策   Current Situation and Policies	2.0	64	64						1	1	1	1	1	1	1	1
		外语类 Foreign Language Courses	0211003101	大学外语I   College EnglishI	3.0	48						3								
			0211003201	大学外语II*   College English II*	3.0	48							3							
			0241003301	大学外语III   College English III	3.0	48	48							3						五选一



课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八			
											1st	2nd	3rd	4th	5th	6th	7th	8th			
通识教育课 General Education	必修 Compulsory	军事安全类 Military and Safety Courses	0710081001	军事理论   Military Theory	1.0	16						2									
			1618041001	安全教育   Safety Education	1.0	16					1	1	1	1	1	1	1				
		劳动体育类 Labor and Sport Education	2640021001	劳动教育   Labour Education	1.0	16	16						1								
			0410011101	大学体育I   College Physical EducationI	1.0	36		36				2									
			0410021201	大学体育II   College Physical EducationII	1.0	36		36					2								
			0410031301	大学体育III   College Physical EducationIII	1.0	36		36						2							
			0410041401	大学体育IV   College Physical EducationIV	1.0	36		36							2						
			创新创业类 Innovation and Entrepreneurship Courses	1617021002	创造性思维与创新方法   Creative Thinking and Innovative Methods	1.0	16	16								2					
		1740011001		创业基础   Entrepreneurial Foundation	1.0	16	16								2						
		心理健康类 Mental Health Courses	0510041001	大学生心理与健康教育   Mental and Health Education for College Students	1.0	16	16					2									
		小计 Subtotal					39.0	736	488	144	0	72	8	8	7	8	6	0	1	2	
		选修 Optional		分为经济管理类、美育类、科学技术类、四史、传统文化、中国与世界课程类 6 个模块 每个模块最多选修 2.0 学分，每学期最多选修 2 门课程。 Including 6 modules: Economic Management, Aesthetic Education, Science and Technology, Four Histories, Traditional Chinese Culture, China and The world. Up to 2.0 credits per module and up to 2 courses per semester.																	
				小计 Subtotal					8						1					7	

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
	实践 Practice		0415102011	军训   Military Training	2.0	48				48	+2								集中	
合计 Total					49.0	944	488	144	0	120	11	8	7	8	6	7	1	2		
学科平台课 Discipline Education	必修 Compulsory	数学与自然科学类 Natural Science & Mathematics	0310004101	高等数学 I*   Advanced Mathematics I*	4.5	80	72			8	6									
			0310005201	高等数学 II*   Advanced Mathematics II*	5.5	96	88			8	6									
			0310063001	大学物理*   University Physics	3.0	48	48				3									
			0310034001	线性代数   Linear Algebra	4.0	64	64					4								
			0317184001	概率论与数理统计   Probability and Statistics	4.0	64	64						4							
			1617052002	离散数学 I*   Discrete Mathematics I*	2.5	40	40				3									
			1612012002	离散数学 II    Discrete Mathematics II	2.0	32	32					2								
		工程基础类 Foundation Engineering	1610052002	计算机科学导论   Introduction to Computer Science	2.0	32	32				2									
			1612021002	工程导论    Introduction to Engineering	1.0	16	16				2									
			1612051002	文献检索与科技论文写作   Document Retrieval and Scientific Paper Writing	1.0	18	12	6						2						



课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八			
											1st	2nd	3rd	4th	5th	6th	7th	8th			
学科平台课 Discipline Education	必修 Compulsory	工程基础类 Foundation Engineering	1617012002	计算机学科专业外语   English for Computer Specialty	2.0	32	32							2							
			1610041202	C 语言程序设计 II   C Programming Language II	1.5	24	24			2											
			1610992002	Java 语言程序设计   Java Language Programming	2.5	40	40						3								
			1610243002	数字逻辑   Digital Logic	3.0	52	40	12				3									
			1620573002	.NET 架构与程序设计   .NET Architecture and Programming	3.0	56	32	24								2					
			1623512002	Web 软件开发与设计   Web Software Development and Design	2.5	44	32	12							2						
			1613742002	人机交互技术   Human-Computer Interface Technology	2.0	36	24	12								2					
			1623501002	Oracle 数据库   Oracle Database	1.5	24	24								2						
			1650752102	程序设计竞赛 I   Program Design Competition I	2.5	48	24	24						2							
			1644270002	学业与专业教育   Academic and Professional Education	0.5	8	8				2										
			1610842002	物联网技术概述   Overview of Internet of Things Technology	2.0	40	16	24									2				
			1620733002	UML 与系统分析设计*   UML and System Analysis and Design Techniques*	3.5	64	40	24									3				

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
学科平台课 Discipline Education	必修 Compulsory	专业基础类 Subject Foundation Requisite	1620743002	软件质量保障与项目管理*   Software Quality Assurance and Project Management*	3.0	48	48									3				
			1618171002	Python 语言程序设计   Python Programming	1.5	24	24					2								
			小计 Subtotal		60.5	1030	876	138	0	16	10.5	12	9.5	9	6	13.5	0	0		
	实践 Practice		1615010032	认识实习   Cognition Practice	0.5	12					2									
			0310081011	大学物理实验   Physical Experiment of College	1.0	24	6	18				2								
			1615232032	生产实习   Production Practice	2.0	48												+2		集中
			1612801022	C 语言实践   Practices for C Language	1.5	36		36				2								
			1618171022	Python 语言实践   Practices for Python Language	1.0	24		24					2							
			小计 Subtotal		0	144	6	78	0	0	0	2	2	0	0	0	0	2	0	
	合计 Total					66.5	1174	882	216	0	16	10.5	14	11.5	9	6	13.5	2	0	
	专业教育课 Specialized Education	必修 Compulsory	1610043102	C 语言程序设计 I*   C Programming Language I	3.0	56	32	24			2									
			1610083002	算法与数据结构*   Algorithm and Data Structures	3.0	52	40	12					3							
			1610073002	面向对象程序设计*   Object-Oriented Programming	3.0	56	32	24					2							
1610093002			计算机组成原理*   Computer Organization and Architecture	3.0	52	40	12						3							



课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八	
										1st	2nd	3rd	4th	5th	6th	7th	8th	
	选修 Optional	小计 Subtotal		2	292	208	84	0	0	0	0	0	2	0	0	0		
(专业选修学分必须修满 2 学分以上 Professional elective credits must be more than 2 credits)																		
专业教育课 Specialized Education	实践 Practice	1615351022	Java 语言实践    Practices for Java Language	1.5	36		36					2						
		1617161022	Oracle 数据库课程设计    Practices for Oracle Database	1.0	24		24						2					
		1615031022	算法与数据结构实践   Practices for Algorithm and Data Structures	1.5	36		36					2						
		1613751022	软件工程实践    Practice for Software Engineering	1.0	24		24						2					
		1615441022	软件测试与项目管理实践   Practice for Software Testing and Project Management	1.5	36		36							2				
		1617031042	毕业设计 (论文)   Graduation Design (Thesis)	14														+14
		1614311022	操作系统课程设计   Course Design of Operating System	1.0	24		24							2				
		小计 Subtotal		21.5	180	0	180	0		0	0	1.5	1.5	3	1.5	0	14	
合计 Total				48.5	908	536	372	0	0	3	0	7.5	10	10.5	3.5	0	14	
能力拓展课 Competency Development	必修或实践 Compulsory or Practice	1617045022	学科特色实践   Discipline Characteristic Practice	5	120		120									12	CDIO 课 程	
		小计 Subtotal		5	120	0	120	0								5		
		(本模块为必修实践环节 This module is a required practice)																
总计 Sum				169	3160	1930	852	0	128	24.5	23	26	28	19.5	24	8	16	

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T. C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
课外实践 环节 Extracurricular Practice	课外实践 Extracurricular Practice	人文社会实践 Culture and Society Practice	1614010012	社会调查   Social Survey	0.5	12				12								0.5	分散	
		身心健康社会实践 Mentally and Physically Practice	0410050751	课外体育锻炼   Extracurricular Physical Exercise	0.5	12				12									0.5	分散
			2640030011	劳动教育实践   Labour Education Practice	0.5	12				12	0.5									分散
			0510070311	心理健康辅导   Mental Health Counseling	0.5	12				12									0.5	分散
			外语技能实践类 Foreign Language Proficiency Training Practice	0210010011	外语技能实践（初级）   Foreign Language Proficiency Training Practice (Elementary)	2.0	48				48				2					
		0210020011		外语技能实践（高级）   Foreign Language Proficiency Training Practice (Advanced)	2.0	48				48				2						
		能力与创新实践 Capability and Innovation Practice	1615494011	大学生素质拓展与创新实践   Quality Development and Innovation Practice	4.0	96				96	1~8 学期依据《沈阳化工大学创新创业实践学分认定办法》由创新创业学院认定								分散	
		成长规划类 Growth Planning Courses	1617601301	职业规划与就业指导   Career Planning and Employment Guidance	1	40	40					1							1	
小计 Subtotal																				

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5,课程名称中画\*为考试课。

## 十、软件专业学士学位课程一览表

**A list of bachelor's degree programs in software engineering**

课程类别 Course Type	模块名称 Modules	序号 No.	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester
通识教育课 General Education	思政类 Ideological and Political Courses	1	0710103001	马克思主义基本原理*   Basic Principles of Marxism*	3	3
		2	0710133001	毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3	4
学科平台课 Discipline Education	数学与自然科学类 Natural Science & Mathematics	3	0310014101	高等数学I* Advanced Mathematics I*	4.5	1
		4	0310005201	高等数学II* Advanced Mathematics II*	5.5	2
		5	1617052002	离散数学 I* Discrete Mathematics I*	2.5	1
	专业基础 Subject Foundation Requisite	6	1620733002	UML 与系统分析设计*   UML and System Analysis and Design Techniques*	3.5	6
		7	1620743002	软件质量保障与项目管理*   Software Quality Assurance and Project Management*	3	6
专业教育课 Specialized Education	必修 Compulsory	8	1610123002	数据库系统原理*   Principle of Database System*	3	4
		9	1610043102	C 语言程序设计 I*   C Programming Language I	3	1
		10	1614332002	操作系统*   Operating System	2.5	5
		11	1610142002	计算机网络*  Computer Networking	2.5	5
		12	1610152002	软件工程*   Software Engineering	2.5	5
		13	1610093002	计算机组成原理*   Computer Organization and Architecture	3	4
		14	1610112002	编译原理*   Compiler Construction Principles	2.5	4
		15	1610083002	算法与数据结构*   Algorithm and Data Structures	3	3
		16	1610073002	面向对象程序设计*   Object-Oriented Programming	3	3

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》

### 十一、全学程实践环节周历安排 Weekly Calendar of all Practice Sessions

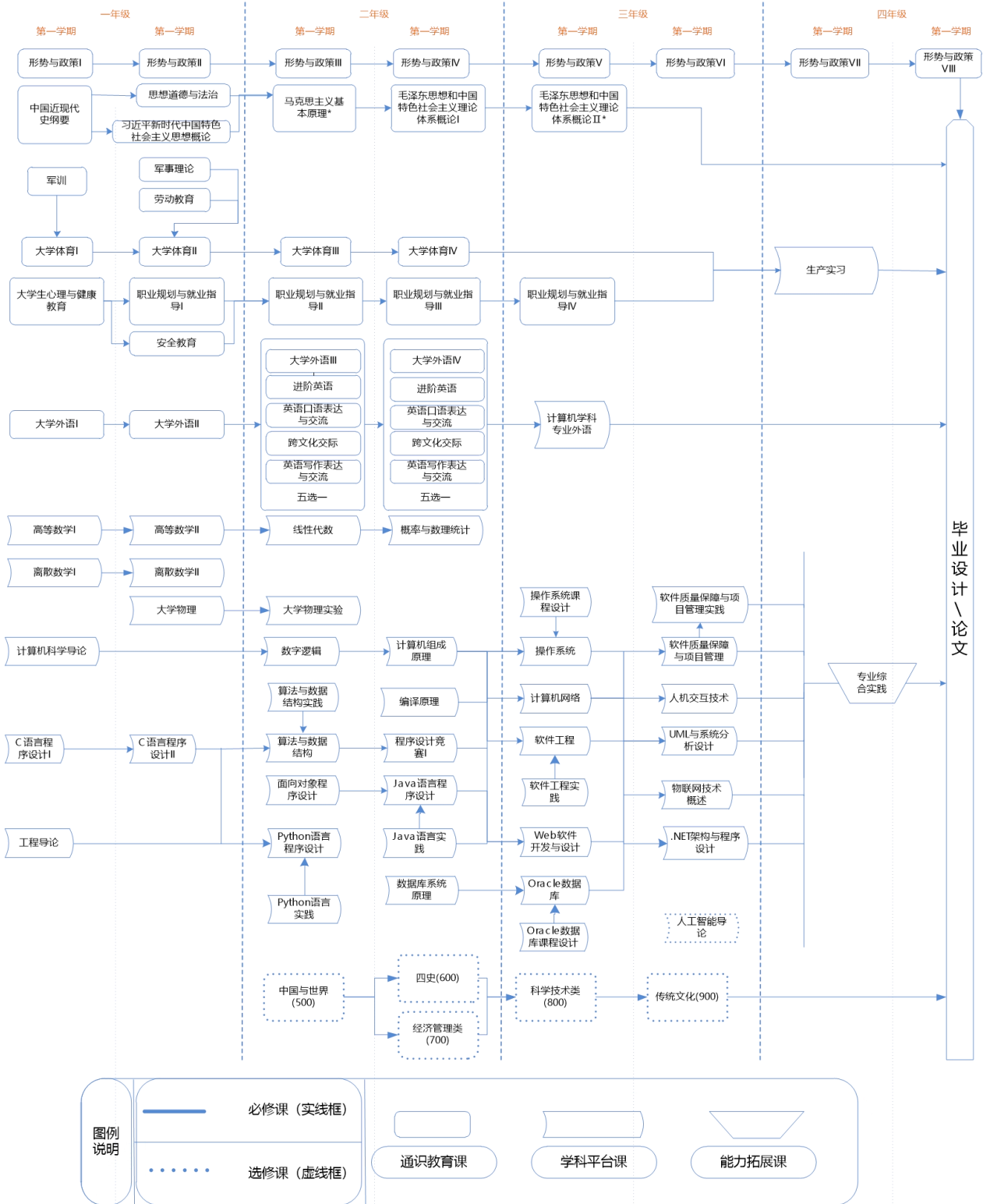
学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注
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八	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=					

1057

符号说明(Symbol Description):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P 各类实训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计(论文)||Graduation Project(Thesis) ·小学期||Primary Term

## 十二、课程体系配置图 Curriculum System Configuration Diagram





十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements ( High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																			
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	12.2	
思想道德与法治    Ideological Morality and the Rule of Law																								H	H	H										
中国近现代史纲要    Outline of Chinese Contemporary and Modern History																								H												
马克思主义基本原理*    Basic Principles of Marxism*																								H												
习近平新时代中国特色社会主义思想概论    Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																								H								H	H			
毛泽东思想和中国特色社会主义理论体系概论    Mao Zedong Thought and Theory of Socialism with Chinese Characteristics																								H							H	H				
形势与政策    Current Situation and Policies												H								H		M		H												
大学外语I-IV    College English I-II																												H			H				H	H
军事理论    Military Theory																								M												
安全教育    Safety Education												H									H												M			



课程 (Courses)	毕业能力要求 (Graduation Requirements)																																		
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	12.2
计算机科学导论   Introduction to Computer Science	L																		H		H				H					M					
工程导论    Introduction to Engineering									H											H						M	H								
文献检索与科技论文写作   Document Retrieval and Scientific Paper Writing																												H		H					
计算机学科专业外语   English for Computer Specialty																						L								H					
C 语言程序设计 II   C Programming Language II			H												H																				
Java 语言程序设计   Java Language			H												H																				
数字逻辑   Digital Logic			M		H							M																							
.NET 架构与程序设计   .NET Architecture and Programming										H							H																		
Web 软件开发与设计   Web Software Development and Design			H							H																									
人机交互技术   Human-Computer Interface technology												H																	H						
Oracle 数据库   Oracle Database						H										H																			
程序设计竞赛 I    Program Design Competition I			M			H	H																												
学业与专业教育   Academic and Professional Education																			M							H									H

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																					
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	12.2			
物联网技术概述   Overview of Internet of Things Technology		H												M																								
UML 与系统分析设计*   UML and System Analysis and Design Techniques*															H	H																						
Python 语言程序设计   Python Programming			H												H																							
认识实习   Cognition Practice																		H	L	M																		
大学物理实验   Physical Experiment of College													H	H	L																							
生产实习   Production Practice																		H		M		H			H				H									
C 语言实践   Practices for C Language										H			H			H																						
C 语言程序设计 I*   C Programming Language I		H													H																							
算法与数据结构*   Algorithm and Data Structures		H	M			H						H																										
面向对象程序设计*   Object-Oriented Programming			H	M			H																															
计算机组成原理*   Computer Organization and Architecture				H	M							H																										
数据库系统原理*   Principle of Database System			M			H																																
编译原理*   Compiler Construction Principles			H				H																															

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																								
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	12.2						
计算机网络*   Computer Networking				H								H							M																						
操作系统*   Operating System				H	H			L				H																													
软件工程*   Software Engineering							H		H		H									H		H											H								
算法与数据结构实践   Practices for Algorithm and Data Structures		H											H																												
软件工程实践   Practice for Software Engineering										H			H															H													
Python 语言实践   Practices for Python Language										H			H					H																							
操作系统课程设计   Course Design of Operating System													H	H																											
软件测试与项目管理实践   Practice for Software Testing and Project Management																H																									
毕业设计 (论文)   Graduation Design (Thesis)							M	H			M		M	H		H				H											H	H		H		H					
Java 语言实践   Practices for Java Language										H			H			H		H																							
Oracle 数据库课程设计   Practices for Oracle Database																M														M											
学科特色实践   Professional Comprehensive Practice								H			M		M	H																				H		H					H

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																				
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	12.2		
软件质量保障与项目管理*   Software Quality Assurance and Project Management*																M							H					H							H		
大学生心理与健康教育   Mental and Health Education for College Students																								H													

# 沈阳化工大学本科培养方案

## 计算机科学与技术学院

专业名称：网络工程

专业代码：080903

制 定：刘 俊

审 核：张 波

审 定：于三三

批 准：金志浩

2021 年 8 月

# 网络工程专业培养方案

## 一、培养目标

本专业培养德、智、体、美、劳全面发展，能够运用数学、自然科学和计算机科学的基础知识，综合运用网络工程领域的科学理论及应用技术，从事网络系统规划与设计、实施与运维、网络安全保障、网络应用开发或相关 IT 工程技术实践。毕业生能在信息技术企业或其他各行各业中信息技术部门和管理部门，独立胜任网络软件工程师、系统集成工程师和网络安全工程师等岗位职责和技术要求的高素质应用型人才。

本专业毕业生具有如下目标预测：

- (1) 具备高度的社会责任感和良好的工程职业道德；能在工程实践过程中进行有效的沟通与表达；
- (2) 能够在网络工程实践活动中，快速准确的完成科学分析，并运用计算机学科知识进一步解决实践问题；
- (3) 能够在网络工程实践活动中，准确运用网络工程的专业思想与工程能力，通过网络工程领域的知识、技术和方法解决现实世界中的复杂网络工程问题；
- (4) 具备网络应用系统设计与开发、网络工程系统规划与设计、网络系统实施与运维，以及网络安全保障能力，并能在复杂网络工程实践中得到应用；
- (5) 在网络工程实践过程中体现团队精神、创新和创业意识，具有良好职业发展力和适应力。

## 二、专业方向

网络工程

## 三、毕业要求

本专业毕业生在毕业时，应该具备较强的社会责任感和基本人文素养；理解与掌握数学、自然科学和计算机科学的理论知识；理解和掌握复杂网络工程领域的规划与设计原理、应用系统开发流程、网络安全实施的原理等知识，接受科学思维和科学实验的基本训练；接受从事研究与应用计算机网络的基本训练，在网络规划设计、网络管理与网络安全、网络应用系统开发和网络工程测试等方面具有较宽的工程技术基础和一定的专业知识。具有较强的相关技术处理能力和一定的系统分析能力；了解本专业的发展方向和最新成就，具有较强的自学能力和不断更新知识的能力；较熟练掌握一门外语。

毕业能力要求及其指标点分解：

毕业能力要求	指标点
毕业要求 1： 工程知识 能够将数学、自然科学、工程基础和计算机科学知识用于解决复杂网络工程问题	1-1 掌握数学与自然科学知识、方法与思想，并用于复杂网络工程过程中的抽象思维和逻辑分析
	1-2 掌握计算机学科的基础知识、基本方法和基本思想，并用于复杂网络工程过程中，网络系统和相关算法方面的构思、分析与设计
	1-3 掌握网络工程领域的基本知识、基本方法和工程思想，用于复杂网络工程过程中，网络系统的规划、网络安全系统规划、应用系统开发等方面的构思、设计、实施与分析。



<p>毕业要求 2: 问题分析</p> <p>能够应用数学、自然科学和计算机科学的基本原理, 识别、表达、并通过文献研究分析复杂网络工程问题, 以获得有效结论</p>	2-1. 掌握数学、物理和计算机科学的基本原理, 在复杂网络工程问题的识别和判断过程中展示科学思维能力
	2-2. 能根据数学、物理和计算机科学的基本原理, 正确表达复杂网络工程的关键问题
	2-3. 能利用文献资料进行分析和研究, 并能得出有效的结论
<p>毕业要求 3: 设计解决方案</p> <p>能够设计针对复杂网络工程问题的解决方案, 包括满足特定需求的网络系统设计、部件选择、工程实施流程或方案设计, 并能够在设计环节中体现创新意识, 考虑社会、健康、安全、法律、文化以及环境等因素</p>	3-1. 掌握网络工程领域规划与设计、管理与维护、安全与保障、软件分析与设计的基本设计/开发方法和技术
	3-2. 能根据工程实践学习经历设计出复杂网络工程问题的解决方案
	3-3. 根据解决方案, 能针对某个特定需求完成部件选择、部件设计、工程实施过程等, 并能体现创新意识
	3-4. 理解社会、健康、安全、法律、文化和环境对于复杂网络工程解决方案的影响, 并得出有效结论
<p>毕业要求 4: 问题研究</p> <p>能够基于科学原理并采用科学方法对复杂网络工程问题进行研究, 包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论</p>	4-1. 掌握网络工程领域的科学原理和科学方法, 并能在研究复杂网络工程问题中得到运用
	4-2. 针对研究的内容, 提出研究思路和实验方法, 并能够设计实验过程、收集实验数据
	4-3. 针对研究内容和实验结果, 综合分析实验数据, 并给出合理有效得结论
<p>毕业要求 5: 使用现代工具</p> <p>能够针对复杂网络工程问题, 开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具, 包括对复杂工程问题的预测与模拟, 并能够理解其局限性</p>	5-1. 能够选择和利用基本的信息技术工具和网络工程工具, 结合适当的技术与资源, 用于复杂网络工程问题的预测与分析
	5-2. 能够针对复杂网络工程问题, 选择恰当的虚拟仿真工具或方法, 对网络系统或其解决方案进行必要的模拟与预测, 并能够理解仿真模拟系统与真实系统之间的差异
	5-3. 能够使用恰当的技术、资源对现代工程工具和信息技术工具进行开发, 解决复杂网络工程中特定的问题, 解决各个部件之间的接口与联系, 并能够理解其局限性
<p>毕业要求 6: 工程与社会</p> <p>能够基于网络工程相关背景知识进行合理分析, 评价网络工程实践和复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响, 并理解应承担的责任</p>	6-1. 能够了解互联网和信息安全相关的法律、法规, 并理解网络系统或网络工程实践对于社会、健康、安全、法律以及文化的可能影响
	6-2. 能够基于网络工程专业知识, 结合相关的应用背景知识, 评价网络系统解决方案或网络工程实践对于社会、健康、安全、法律以及文化的可能影响, 并理解应承担的责任
<p>毕业要求 7: 环境和可持续发展</p> <p>能够理解和评价针对复杂网络工程问题的工程实践对环境、社会可持续发展的影响</p>	7-1. 具有环境保护的自觉和可持续发展的意识; 了解环境保护与可持续发展相关的方针与政策、法律与法规
	7-2. 能够理解实际解决方案和工程实践的可持续性, 理解和评价复杂网络工程问题的解决方案和网络工程专业工程实践对环境、社会可持续发展的影响
<p>毕业要求 8: 职业规范</p> <p>具有人文社会科学素养、社会责任感, 能够在网络工程实践中理解并遵守工程职业道德和规范, 履行责任</p>	8-1. 具有基本的人文社会素养, 能够运用历史、哲学的知识和方法认识、分析社会现象, 理解个人与社会的关系, 了解中国国情。
	8-2. 能够拥有健康的体质, 具有正确的价值观, 具有良好的心理素质和社会责任感
	8-3. 理解诚实公正、诚实守信的网络工程领域的工程职业道德和规范, 并能自觉遵守, 理解网络工程领域工程师对公众的社会责任
<p>毕业要求 9: 个人和团队</p> <p>能够在多学科背景下的团队中承担个体、</p>	9-1. 在多学科背景下明确团队的角色构成和职责分工, 能够具有团队合作意识, 能够提出自己的想法并且倾听其他成员的意见和建议

团队成员以及负责人的角色	9-2. 能够与团队其他成员有效沟通,能够在团队中承担个体、团队成员以及负责人的角色,并完成团队分配的任务
毕业要求 10: 沟通 能够就复杂网络工程问题与业界同行及社会公众进行有效沟通和交流,包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。并具备一定的国际视野,能够在跨文化背景下进行沟通和交流	10-1. 具备沟通交流的基本技巧与能力,良好的口头与书面表达能力,有效表达自己思想与意愿的能力,倾听与理解他人需求和意愿的能力,适应工作与人际环境变化的能力 10-2. 能够依照相关的工程标准或行业规范,进行网络工程相关技术问题及文档(如需求分析报告、系统设计方案、系统实施方案等)的书面表达和口头交流 10-3. 具备一门外国语的基本听、说、读、写、译能力,能够阅读网络工程专业领域的外文资料,能够在跨文化背景下进行沟通和交流
毕业要求 11: 项目管理 理解并掌握工程管理原理与经济决策方法,并能在多学科环境中应用	11-1. 能够理解和掌握网络工程的管理原理和经济决策方法 11-2. 能够在解决网络工程方案设计过程中,运用工程管理和经济决策的方法
毕业要求 12: 终身学习 具有自主学习和终身学习的意识,有不断学习和适应发展的能力	12-1. 具有自主学习和终身学习意识 12-2. 具有自主学习的能力,包括对技术问题的理解能力、归纳总结的能力和解决问题的能力

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。

### 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标				
	培养目标 1	培养目标 2	培养目标 3	培养目标 4	培养目标 5
1: 工程知识		√			
2: 问题分析		√	√	√	
3: 设计/开发解决方案			√	√	
4: 研究			√	√	
5: 使用现代工具		√	√	√	√
6: 工程与社会	√				
7: 环境和可持续发展	√				
8: 职业规范	√				
9: 个人和团队	√				
10: 沟通	√				
11: 项目管理					√
12: 终身学习					√

#### 四、主干学科

计算机科学与技术

#### 五、专业核心课程

C 语言程序设计 I、离散数学 I、计算机组成原理、算法与数据结构、操作系统、计算机网络、面向对象程序设计、数据库系统原理、网络编程技术、网络安全技术、物联网技术概述

## 六、修业年限

本科基本学制 4 年，弹性学习年限 3-6 年，按照学分管理制度管理。

## 七、授予学位

学生应至少修满 169 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者，可授予工学学士学位。

## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例(%)
通识教育课	通识教育必修课	思政类	必修	17	39	23.08
		外语类		12		
		军事安全类		2		
		劳动体育类		5		
		创新创业类		2		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	1	8	4.73
		中国与世界(500)		2		
		四史(600)		1		
		经济管理类(700)		1		
		科学技术类(800)		1		
传统文化(900)		2				
通识教育实践课	军训	实践	2	2	1.18	
学科平台课	学科基础课程	数学与自然科学类	必修	25.5	70.5	41.72
		工程基础类		7		
		专业基础类		32		
	学科实践课程	-	实践	6		
专业教育课	专业必修课程	-	必修	12.5	44.5	26.33
	专业选修课程	-	选修	2		
	专业实践课程	-	实践	30		
能力拓展课	专业特色课程	-	实践	5	5	2.96
课外环节	课外通识实践	人文社会实践	课外实践	4		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
	生涯教育	成长规划类				
总学分/比例					169	100%

# Network Engineering Major 2021 Undergraduate Education Program

## I. Educational Objectives

This major cultivates students with all-round development in morality, intelligence, sports, beauty and labor, who can use the basic knowledge of mathematics, natural science and computer science, comprehensively use the scientific theory and application technology in the field of network engineering, and engage in network system planning and design, implementation, operation and maintenance, network security, network application development or related it engineering technology practice. Graduates can work independently in information technology department and management department of enterprises or other industries as competent network software engineer, system integration engineer and network security engineer with post responsibilities and technical requirements of high-quality application-oriented talents.

Graduates should obtain knowledge and competences as follows:

(1) Have a high sense of social responsibility and good engineering professional ethics; Able to communicate and express effectively in engineering practice;

(2) Be able to complete scientific analysis quickly and accurately in network engineering practice activities, and further solve practical problems with computer knowledge;

(3) Be able to accurately use professional thoughts and engineering capabilities of network engineering in network engineering practice activities, and solve complex network engineering problems in the real world through knowledge, technology and methods in the field of network engineering;

(4) Have the ability of network application system design and development, network engineering system planning and design, network system implementation and operation and maintenance, and network security guarantee, and can be applied in complex network engineering practice;

(5) Embody team spirit, innovation and entrepreneurship consciousness in network engineering practice, and have good career development and adaptability.

## II. Major Direction

Network Engineering

## III. Graduation Requirements

Graduates of this major should have a strong sense of social responsibility and basic humanistic quality when they graduate; Understand and master the theoretical knowledge of mathematics, natural science and computer science; Understand and master the planning and design principles, application system development process, network security implementation principles and other knowledge in the field of complex network engineering, and accept the basic training of scientific thinking and scientific experiments; Accept the basic training of research and application of computer network, have a wide engineering technology foundation and certain professional knowledge in network planning and design, network management and network security, network application system development and network engineering testing; Have strong ability of relevant technology processing and

system analysis; Understand the development direction and latest achievements of the major; have strong self-learning ability and the ability to constantly update knowledge; Master a foreign language well.

Graduates should obtain knowledge and competences as follows:

Graduation Requirements	Indices
<p>Requirement 1: Engineering Knowledge Be able to use mathematics, natural science, engineering foundation and computer science knowledge to solve complex network engineering problems</p>	1-1. Master the knowledge, methods and ideas of mathematics and natural science, and apply them to abstract thinking and logical analysis in the process of complex network engineering
	1-2. Master the basic knowledge, basic methods and basic ideas of computer science, and apply them to the conception, analysis and design of network system and related algorithms in the process of complex network engineering
	1-3. Master the basic knowledge, basic methods and engineering ideas in the field of network engineering, and apply them to the conception, design, implementation and analysis of network system planning and implementation, operation and maintenance and management, network security, application system design and implementation in the process of complex network engineering.
<p>Requirement 2: Problem Analysis Be able to apply the basic principles of mathematics, natural science and computer science to identify, express and analyze complex network engineering problems through literature research, so as to obtain effective conclusions</p>	2-1. Master the basic principles of mathematics, physics and computer science, and demonstrate the ability of scientific thinking in the process of identifying and judging complex network engineering problems
	2-2. Be able to correctly express the key problems of complex network engineering according to the basic principles of mathematics, physics and computer science
	2-3. Be able to analyze and research with literature and draw effective conclusions
<p>Requirement 3: Design/Development Solutions Be able to design solutions for complex network engineering problems, including network system design, component selection, project implementation process or scheme design to meet specific needs, and be able to reflect the sense of innovation in the design process, considering social, health, safety, legal, cultural and environmental factors</p>	3-1. Master the basic design / development methods and technologies of network engineering planning and design, management and maintenance, security and assurance, software analysis and design
	3-2. Be able to design solutions to complex network engineering problems according to engineering practice and learning experience
	3-3. According to the solution, be able to complete the component selection, component design, engineering implementation process, etc. for a specific demand, and embody the innovation consciousness
	3-4. Understand the impact of society, health, safety, law, culture and environment on complex network engineering solutions and draw effective conclusions
<p>Requirement 4: Research Based on scientific principles and scientific methods, we can study complex network engineering problems, including designing experiments, analyzing and interpreting data, and getting reasonable and effective conclusions through information synthesis</p>	4-1. Master the scientific principles and methods in the field of network engineering, and be able to apply them in the study of complex network engineering problems
	4-2. According to the research content, put forward research ideas and experimental methods, and be able to design the experimental process and collect experimental data
	4-3. According to the research content and experimental results, comprehensively analyze experimental data and give reasonable and effective conclusions
<p>Requirement 5: Use of Modern Tools Be able to develop, select and use appropriate technologies, resources,</p>	5-1. Be able to select and use basic information technology tools and network engineering tools, combined with appropriate technologies and resources, to predict and analyze complex network engineering problems

modern engineering tools and information technology tools for complex network engineering problems, including prediction and simulation of complex engineering problems, and understand their limitations	5-2. Be able to select appropriate virtual simulation tools or methods for complex network engineering problems, conduct necessary simulation and prediction for network system or its solutions, and understand the differences between simulation system and real system
	5-3. Be able to use appropriate technology and resources to develop modern engineering tools and information technology tools, solve specific problems in complex network engineering, solve interfaces and connections between various components, and understand their limitations
Requirement 6: Engineering and Society Be able to make reasonable analysis based on the relevant background knowledge of network engineering, evaluate the impact of network engineering practice and complex engineering problem solutions on society, health, safety, law and culture, and understand the responsibilities	6-1. Be able to understand the laws and regulations related to Internet and information security, and understand the possible impact of network system or network engineering practice on society, health, safety, law and culture
	6-2. Be able to evaluate the possible impact of network system solutions or network engineering practices on society, health, safety, law and culture based on network engineering professional knowledge and relevant application background knowledge, and understand the responsibilities to be undertaken
Requirement 7: Environment and Sustainable Development Be able to understand and evaluate the impact of engineering practice on the sustainable development of environment and society	7-1. Have the consciousness of environmental protection and sustainable development; Understand the guidelines, policies, laws and regulations related to environmental protection and sustainable development
	7-2. Be able to understand the sustainability of practical solutions and engineering practices, and understand and evaluate the impact of solutions to complex network engineering problems and network engineering professional engineering practices on environmental and social sustainable development
Requirement 8: Career Planning Have humanities and social science literacy, sense of social responsibility, be able to understand and abide by engineering professional ethics and norms in network engineering practice, and fulfill responsibilities	8-1. Have basic humanistic and social literacy, be able to use historical and philosophical knowledge and methods to understand and analyze social phenomena, understand the relationship between individuals and society, and understand China's national conditions
	8-2. Be able to have a healthy constitution, correct values, good psychological quality and sense of social responsibility
	8-3. Understand the engineering professional ethics and norms in the field of honest, just and trustworthy network engineering, and consciously abide by them, and understand the social responsibility of engineers to the public in the field of network engineering
Requirement 9: Individuals and Teams Be able to play the role of individual, team member and leader in a multidisciplinary team	9-1. Be clear about the role composition and responsibility division of the team under the multidisciplinary background, be able to have a sense of teamwork, be able to put forward their own ideas and listen to the opinions and suggestions of other members
	9-2. Be able to communicate with other team members effectively, take on the role of individual, team member and leader in the team, and complete the tasks assigned by the team
Requirement 10: Communication Be able to effectively communicate with peers and the public on complex network engineering issues, including writing reports and designing manuscripts, making statements, clearly expressing or responding to instructions; have a certain	10-1. Have the basic skills and ability of communication, good oral and written expression ability, the ability to effectively express their own thoughts and wishes, the ability to listen to and understand the needs and wishes of others, and the ability to adapt to the changes of work and interpersonal environment
	10-2. Be able to make written expression and oral communication of network engineering related technical problems and documents (such as requirement analysis report, system design scheme, system implementation scheme, etc.) in accordance

international vision; be able to communicate and exchange in the cross-cultural background	with relevant engineering standards or industry specifications
	10-3. Have the basic ability of listening, speaking, reading, writing and translating in a foreign language, be able to read foreign materials in the field of network engineering, have a certain international vision, and be able to communicate and exchange under the cross-cultural background
Requirement 11: Project Management Understand and master engineering management principles and economic decision-making methods, and be able to apply them in a multidisciplinary environment	11-1. Be able to understand and master the management principles and economic decision-making methods of network engineering
	11-2. Be able to use engineering management and economic decision-making methods in the process of solving network engineering scheme design
Requirement 12: Lifelong Learning Have the consciousness of self-learning and lifelong learning, have the ability of continuous learning and adapting to development	12-1. Have the consciousness of self-learning and lifelong learning
	12-2. Have the ability of autonomous learning, including the ability to understand, summarize and solve technical problems

### The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives				
	Educational Objectives 1	Educational Objectives 2	Educational Objectives 3	Educational Objectives 4	Educational Objectives 5
1: Engineering Knowledge		R			
2: Problem Analysis		R	R	R	
3: Design/Development Solutions			R	R	
4: Research			R	R	
5: Use of Modern Tools		R	R	R	R
6: Engineering and Society	R				
7: Environment and Sustainable Development	R				
8: Career Planning	R				
9: Individuals and Teams	R				
10: Communicate	R				
11: Project Management					R
12: Lifelong Learning					R

#### IV. Major Subject

Computer Science and Technology

#### V. Core Courses



C Language Programming I, Discrete Mathematics I, Computer Composition Principle, Algorithm and Data Structure, Operating System, Computer Network, Object-Oriented Programming, Database System Principle, Network Programming Technology, Network Security Technology, Internet of Things Technology Overview

## **VI. Educational System**

The basic length of undergraduate education is 4 years, and the flexible study period is 3-6 years. It is managed according to the credit system.

## **VII. Confer Degrees**

Students should complete at least 169 credits before graduation. The Bachelor of engineering degree can be granted to those who meet the degree awarding requirements of the relevant regulations on the awarding of bachelor's degree for graduates of Shenyang University of Chemical Technology (revised in March 2017).

## VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit requirement	Subtotal	Proportion (%)
General Education	General Education (Compulsory)	Ideological and Political Courses	Compulsory	17	39	23.08
		Foreign Language Courses		12		
		Military and Safety Courses		2		
		Labor and Sport Education		5		
		Innovation and Entrepreneurship		2		
		Mental Health		1		
	General Education (Optional)	Aesthetic Education(400)	Optional	1	8	4.73
		China and the world(500)		2		
		Four Histories(600)		1		
		Economic Management (700)		1		
		Science and Technology (800)		1		
		Traditional Culture(900)		2		
General Education Practice	Military training	Practice	2	2	1.18	
Discipline Education	Basic Courses	Natural Science & Mathematics	Compulsory	25.5	70.5	41.72
		Foundation Engineering		7		
		Subject Foundation Requisite		32		
	Basic Practice Sessions	-	Practice	6		
Specialized Education	Core Courses	-	Compulsory	12.5	44.5	26.33
	Optional Courses	-	Optional	2		
	Specialized Practice Sessions	-	Practice	30		
Competency Development	Individualized Courses	-	Compulsory (or Practice)	5	5	2.96
Extracurricular links	Extracurricular General Education Practice	Culture and Society Practice	Extracurricular Practice	4		
		Mental and Physical Practice				
		Foreign Language Proficiency Training Practice				
	Extracurricular Characteristic Practice	Innovation Training		4		
		Innovation Competition				
		Chuangke activities				
	Career Education	Growth Planning Courses		1		
Total/Proportion					169	100%



九、网络工程专业教学进程表

Table of Teaching Schedule for Network Engineering Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲 课 Lecture	实 验 Exp.	上 机 Pro.	课 外 实 践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
1078 通识教育课 General Education	必修 Compulsory	思政类 Ideological and Political Courses	0710093001	思想道德与法治    Ideological Morality and the Rule of Law	3	48	32			16		2								
			0710053001	中国近现代史纲要   Outline of Chinese Contemporary and Modern History	3	48	32			16	2									
			0710103001	马克思主义基本原理*   Basic Principles of Marxism*	3	48	32			16			2							
			0710123001	习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8					3					
			0710133001	毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3.0	48	32			16				2						
			0710012301	形势与政策   Current Situation and Policies	2	64	64												2	
	外语类 Foreign Language Courses	0211003101	大学外语I   College EnglishI	3	48						3									
		0211003201	大学外语II*   College English II	3	48							3								
		0241003301	大学外语III   College English III	3	48								3						五选一	

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes			
							讲课 Lecture	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八				
											1st	2nd	3rd	4th	5th	6th	7th	8th				
通识教育课 General Education	必修 Compulsory	外语类 Foreign Language Courses	0241003301	大学外语III（进阶英语）    College English III（Advanced English CET 6-Orientated）	48																	
				大学外语III（英语口语表达与交流）    College English III（English Oral Expression and Communication）		48																
				大学外语III（跨文化交际）    College English III（Intercultural Communication）																		
				大学外语III（英语写作表达与交流）    College English III（English Writing Expression and Communication）																		
	0241003401	大学外语IV*   College English IV*	3																			
		大学外语IV（进阶英语）    College EnglishIV（Advanced English CET 6-Orientated）		48																		
		大学外语IV（英语口语表达与交流）    College EnglishIV（English Oral Expression and Communication）			48																	
		大学外语IV（跨文化交际）    College English IV（Intercultural Communication）				48																
		大学外语IV（英语写作表达与交流）    College English IV（English Writing Expression and Communication）					48															

五选一

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
							讲课 Lecture	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八			
											1st	2nd	3rd	4th	5th	6th	7th	8th			
通识教育课 General Education	必修 Compulsory	军事安全类 Military and Safety Courses	0710081001	军事理论   Military Theory	1	16						2									
			1618041001	安全教育   Safety Education	1	16					1	1	1	1	1	1	1				
		劳动体育类 Labor and Sport Education	2640021001	劳动教育   Labour Education	1	16	16					2									
			0410011101	大学体育I   College Physical EducationI	1	36		36			2										
			0410021201	大学体育II   College Physical EducationII	1	36		36				2									
			0410031301	大学体育III   College Physical EducationIII	1	36		36					2								
			0410041401	大学体育 IV   College Physical Education IV	1	36		36						2							
			创新创业类 Innovation and Entrepreneurship Courses	1617021002	创造性思维与创新方法   Creative Thinking and Innovative Methods	1	16								2						
		1740011001		创业基础   Entrepreneurial Foundation	1	16	16								2						
		心理健康类 Mental Health Courses	0510041001	大学生心理与健康教育   Mental and Health Education for College Students		1	16	16				2									
				小计 Subtotal				39	928	280	144	0	72								
			选修 Optional	分为美育类(1.0)、经济管理类(1.0)、科学技术类(1.0)、四史(1.0)、传统文化(2.0)、中国与世界(2.0)课程类6个模块 每个模块最多选修2.0学分,每学期最多选修2门课程。 Including 6 modules: Aesthetic Education(1.0), Economic Management(1.0), Science and Technology(1.0), Four Histories(1.0), Traditional Chinese Culture(2.0), China and The World(2.0). Up to 2.0 credits per module and up to 2 courses per semester.																	

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
						讲课 Lecture	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八			
										1st	2nd	3rd	4th	5th	6th	7th	8th			
通识教育课 General Education	实践 Practice	小计 Subtotal		8																
		0415102011	军训   Military Training	2	48				48	+2									集中	
		小计 Subtotal		2	48				48											
合计 Total				49	976	280	144	0	120											
学科平台课 Discipline Education	必修 Compulsory	数学与自然科学类 Natural Science & Mathematics	0310004101	高等数学 I*   Advanced Mathematics I*	4.5	80	72			8	6									
			0310005201	高等数学 II*   Advanced Mathematics II*	5.5	96	88			8		6								
			0310063001	大学物理*   University Physics*	3	48	46	2					3							
			0310034001	线性代数   Linear Algebra	4	64	64							4						
			0310042001	概率论与数理统计   Probability and Statistics	2	32	32								2					
			1617052002	离散数学 I*   Discrete Mathematics I	2.5	40	40					3								
			1612012002	离散数学 II    Discrete Mathematics II	2	32	32						2							
			1613602002	组合数学   Combinatorial Mathematics	2	32	32							2						
			小计 Subtotal		25.5	424	406	2	0	16										
	工程基础类 Foundation Engineering	1610052002	计算机科学导论   Introduction to Computer Science	2	32	32					2									
1612021002		工程导论   Introduction to Engineering	1	16	16					2										

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lecture	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
学科平台课 Discipline Education	必修 Compulsory	工程基础类 Foundation Engineering	1610243002	数字逻辑   Digital Logic	3	52	40	12				3								
			1612051002	文献检索与科技论文写作   Literature Retrieval and Writing of Scientific Papers	1	18	12	6					2							
			小计 Subtotal		7	118	100	18	0	0										
	必修 Compulsory	专业基础类 Subject Foundation Requisite	1610043102	C 语言程序设计 I*   C Language Programming I*	3	56	32	24			2									
			1610041202	C 语言程序设计 II   C Language Programming II	1.5	24	24				2									
			1610083002	算法与数据结构*   Algorithm and Data Structure*	3	52	40	12					3							
			1610093002	计算机组成原理*   Principles of Computer Organization*	3	52	40	12						3						
			1614332002	操作系统*   Operating System*	2.5	40	40								3					
			1614343002	计算机网络*   Computer Network*	3	52	40	12							3					
			1610123002	数据库系统原理*   Principle of Database System*	3	52	40	12							3					
			1610152002	软件工程   Software Engineering	2.5	40	40									3				
			1614103002	面向对象程序设计   Object-Oriented Programming	3	48	48								3					





课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
						讲课 Lecture	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
										1st	2nd	3rd	4th	5th	6th	7th	8th		
专业教育课 Specialized Education	必修 Compulsory	1610782002	网络安全技术   Network Security Technology	2.5	40	40									3				
		1614132002	网络编程技术   Network Programming Technology	2.5	44	32	12							2					
		1610842002	物联网技术概述   Overview of Internet of Things Technology	2	40	16	24								2				
		1610893002	网络工程技术竞赛   Network Engineering Technology Competition	3	64	16	48							2					CDIO 课程
		1650752102	程序设计竞赛 I   Programming Competition I	2.5	48	24	24					2							
		小计 Subtotal			12.5	236	128	108	0	0									
	选修 Optional	1632832002	数学竞赛   Mathematics Competition	2	32	32											2		
		1632842002	专业技术竞赛   Professional Technology Competition	2	32	32												2	
		0330103001	普通物理   General Physics	3.0	48	48												3	
		1617003002	电路与电子技术基础   Fundamentals of Circuit and Electronic Technology	3	56	32	24					2							
		1634172002	人工智能与大数据分析   Artificial Intelligence and Big Data Analysis	2	36	24	12									2			
		1634192002	移动互联网技术   Mobile Internet Technology	2	36	24	12								2				

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
						讲课 Lecture	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th		
专业教育课 Specialized Education	选修 Optional	1634143002	高级网络编程技术   Advanced Network Programming Technology	3	48	48									3				
		1638002002	Python 语言   Python Language	2	40	16	24								2				
		小计 Subtotal		2	328	256	72	0	0										
	专业选修学分必须修满 2 学分以上 Professional elective credits must be more than 2 credits																		
	实践 Practice	1614212022	企业级软件开发实践 I   Enterprise Software Development Practice I	2	48		48								4				
		1614222022	企业级软件开发实践 II   Enterprise Software Development Practice II	2	48		48									4			
		1618012002	网络安全协议分析   Analysis of Network Security Protocol	2.5	60		60									4			
		1614242022	网络安全规划与实施综合实践   Comprehensive Practice of Network Security Planning and Implementation	2	48		48									4			
		1614252022	物联网管理平台规划与实践   Planning and Practice of Internet of Things Management Platform	2	48		48											4	
1615232032		生产实习   Production Practice	2	48		48											+2	集中	
1618021022		网络测试与评价   Network Test and Evaluation	1.5	36		36											2		
1618032022	网络综合布线技术实践   Practice of Network Generic Cabling Technology	2	48	8	40							4							



课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes
							讲课 Lecture	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八	
											1st	2nd	3rd	4th	5th	6th	7th	8th	
课外 环节 Extracurricular	课外实践 ar Practice	能力与创新实践 Capability and Innovation Practice	1615494011	大学生素质拓展与创新实践   Quality Development and Innovation Practice	4	96				96	1~8 学期依据《沈阳化工大学创新创业实践学分认定办法》由创新创业学院认定								分散
		成长规划类 Growth Planning Courses	1617601301	职业规划与就业指导   Career Planning and Employment Guidance	1	40	40				1					1			
小计 Subtotal					9	280	40	0	0	240	9								

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5,课程名称中画\*为考试课。

Note: “Cre. (Credits)”, “T.C.H. (Total Credit Hours)”, “Lec. (Lecture)”, “Exp. (Experiment)”, “Pro. (Programming)”, “Pra. (Practice)”.

## 九、网络工程专业学士学位课程一览表

### A List of Bachelor's Degree Programs in Network Engineering

课程类别 Course Type	模块名称 Modules	序号 No.	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester			
通识教育课 General Education	思政类 Ideological and Political Courses	1	0710103001	马克思主义基本原理 Elementary Theory of Marxism	3	3			
		2	0710133001	毛泽东思想和中国特色社会主义理论体系概论* Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3	4			
学科平台课 Discipline Education	数学与自然科学类 Natural Science & Mathematics	3	0310004101	高等数学I* Advanced Mathematics I*	4.5	1			
		4	0310005201	高等数学II* Advanced Mathematics II*	5.5	2			
		5	1617052002	离散数学 I*   Discrete Mathematics I	2.5	1			
	专业基础 Subject Foundation Requisite		6	1610043102	C 语言程序设计 I*   C Language Programming I*	3	1		
			7	1610083002	算法与数据结构*   Algorithm and Data Structure*	3	3		
			8	1610093002	计算机组成原理*   Principles of Computer Organization*	3	4		
			9	1614343002	计算机网络*   Computer Network*	3	5		
			10	1614332002	操作系统*   Operating System*	2.5	5		
			11	1614103002	面向对象程序设计   Object-Oriented Programming	3	4		
			12	1610123002	数据库系统原理*   Principle of Database System*	3	4		
			13	1610782002	网络安全技术   Network Security Technology	2.5	6		
			专业教育课 Specialized Education	必修 Compulsory	14	1614132002	网络编程技术   Network Programming Technology	2.5	5
					15	1610842002	物联网技术概述   Overview of Internet of Things Technology	2	6

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》

### 十一、全学程实践环节周历安排 Weekly Calendar of all Practice Sessions

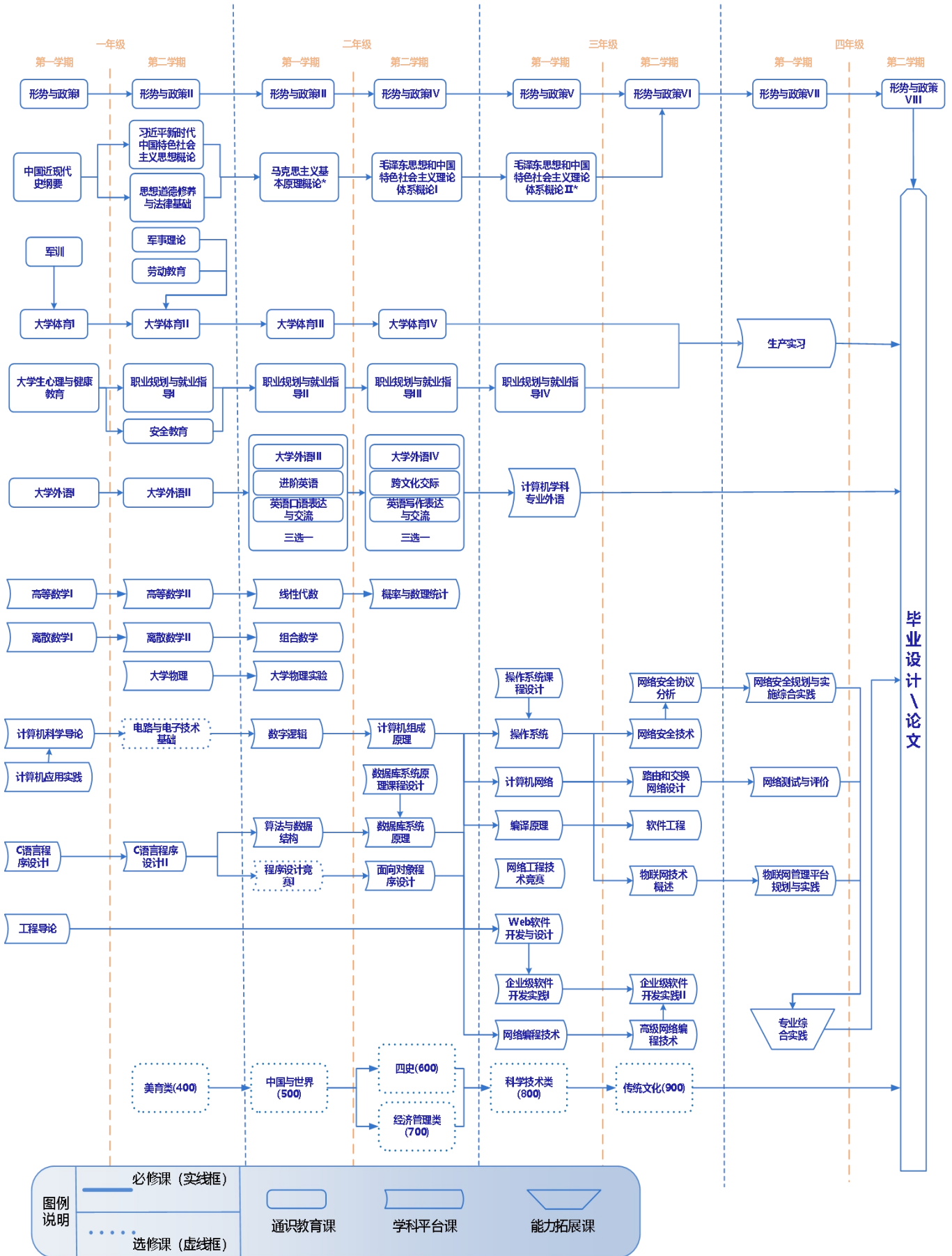
学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注
一		☆	☆															::	::	·		
二																		::	::	·		
三																		::	::	·		
四																		::	::	·		
五																		::	::	·		
六																		::	::	·		
七	P	P	P	P	P	P	/	/										::	::	·		
八	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=					

1089

符号说明(Symbol Description):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P 各类实训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计(论文)||Graduation Project(Thesis)·小学期||Primary Term

## 十二、课程体系配置图 Curriculum System Configuration Diagram





十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements ( High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	11.1	11.2	12.1	12.2	
思想道德修养与法治    Ideological Morality and the Rule of Law																	H				H		H										
中国近现代史纲要   Outline of Chinese Contemporary and Modern History																						H											
马克思主义基本原理*   Elementary Theory of Marxism*																					H	M	H										
习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																				H	H	H		M									
毛泽东思想和中国特色社会主义理论体系概论   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics																				H	H	H		M									
形势与政策   Current Situation and Policies																				H	H	H	H										
大学外语I、II*、III   College EnglishI、II*、III																												H				L	
进阶英语   Advanced English (CET 6-Oriented)																												H				L	
英语口语表达与交流  English Oral Expression and Communication																												H				L	
大学外语IV*   College English IV																												H				L	

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																					
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	11.1	11.2	12.1	12.2						
英语写作表达与交流   English Writing Expression and Communication																															H				L			
跨文化交际   Intercultural Communication																																		H				L
军事理论   Military Theory																		M		M																		
安全教育   Safety Education																		H																		M		
劳动教育   Labour Education																																				M		
大学体育I、II、III、IV   College Physical EducationI、II、III、IV																																				M		
创造性思维与创新方法   Creative Thinking and Innovative Methods										M																												
创业基础   Entrepreneurial Foundation																																				M		
大学生心理与健康教育   Mental and Health Education for College Students																		L	L																H			
军训   Military Training																																				H		
高等数学 I*、II*   Advanced Mathematics I*、II*	H			M																																		
大学物理*   College Physics*	H			M																																		
线性代数   Linear Algebra	H				M																																	

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	11.1	11.2	12.1	12.2	
概率论与数理统计   Probability and Statistics	H																																
离散数学 I*、II   Discrete Mathematics I、II				H							M																						
组合数学   Combinatorial Mathematics				H							M																						
计算机科学导论   Introduction to Computer Science		L												L																			
工程导论   Introduction to Engineering																	M	M	H	H										M			
数字逻辑   Digital Logic	H																																
文献检索与科技论文写作   Literature Retrieval and Writing of Scientific Papers							H							M																			
C 语言程序设计 I*   C Language Programming I*		L			H																												
C 语言程序设计 II   C Language Programming II		M																															
算法与数据结构*   Algorithm and Data Structure*		H			H						H																						
计算机组成原理*   Principles of Computer Organization*		H			H						H																						
操作系统*   Operating System*		H			H						H																						
计算机网络*   Computer Network*			H		H						H																						
数据库系统原理*   Principle of Database System*		H			H						H																						

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																		
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	11.1	11.2	12.1	12.2			
软件工程   Software Engineering		H			H							H																							
面向对象程序设计   Object-Oriented Programming			H				H																												
Web 软件开发与设计   Development and Design of Web Software			H					H																											
计算机学科专业外语   English for Computer Specialty																																H			
编译原理   Principles of Compilation				M								H																							
网络安全技术   Network Security Technology			H				H										M	M						M											
网络编程技术   Network Programming Technology			H					H				H																							
物联网技术概述   Overview of Internet of Things Technology									M					M																					
网络工程技术竞赛   Network Engineering Technology Competition								H	H	H															M	M		H							
大学物理实验    College Physics Experiment				H								L	L																						
计算机应用实践   Computer Application Practice						L								L	L	L																			
数据库系统原理课程设计   Course Design of Database System Principle												H	H																						
路由和交换网络设计   Design of Routing and Switching Network							H	H	H	H																									
操作系统课程设计   Course Design of Operating System												H	H																						

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																	
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	11.1	11.2	12.1	12.2		
企业级软件开发实践 I   Enterprise Software Development Practice I														H	H	H																H	H	
企业级软件开发实践 II   Enterprise Software Development Practice II														H	H	H																H	H	
网络安全协议分析   Analysis of Network Security Protocol						H											H	H																
网络安全规划与实施综合实践   Comprehensive Practice of Network Security Planning and Implementation														H	H	H	L	L						H										
物联网管理平台规划与实践   Planning and Practice of Internet of Things Management Platform																									H	H						H	H	
网络测试与评价   Network Test and Evaluation														H	H	H	L	H	L	L														
网络综合布线技术实践   Practice of Network Generic Cabling Technology														H	H	H																		
毕业设计 (论文)   Graduation Design (Thesis)						H																					H	H		H	H			
专业综合实践   Professional Comprehensive Practice														H	H	H															H	H		H

# 沈阳化工大学本科培养方案

## 计算机科学与技术学院

专业名称：数据科学与大数据技术

专业代码：080910T

制 定：李玉红，王亮

审 核：张 波

审 定：于三三

批 准：金志浩

2021 年 8 月

# 数据科学与大数据技术专业培养方案

## 一、培养目标

本专业培养具有高尚的道德品质、良好职业素养和社会责任感，适应大数据技术发展，满足行业和区域经济建设需求，具有扎实的专业技术基础知识，能够在大数据平台建设、大数据存储与管理、大数据计算、大数据分析可视化等相关领域从事大数据研究、产品研发、应用系统开发、实施与维护的高素质应用型人才。本专业毕业生具有如下目标预测：

(1) 能在社会活动中，综合考虑社会、法律、安全、环境及可持续性等因素，体现高度的社会责任感和工程职业道德，具有服务社会的意愿和能力。

(2) 能够在企业和社会实际环境中，按照大数据工程技术规范，运用相关知识和技术，具有技术研究、产品研发、应用开发和系统实施与维护等能力。

(3) 能够根据大数据技术发展和社会发展需求，在大数据新产品、新技术、新应用等领域，具有研发精神和创新意识，具有积极寻求和获取新知识与新技术的能力。

(4) 能够在社会环境中，熟练运用外语与计算机相关工具，就大数据系统开发、产品研发、新知识新技术等环节，与国内外同行进行有效沟通。

(5) 能在多角色人员构成的团队中，有效地发挥重要作用，进而从系统的视角管理多学科组成的项目。

## 二、专业方向

大数据分析处理

## 三、毕业要求

本专业毕业要求共 12 项，涉及工程知识、问题分析、问题研究、设计解决方案、使用现代工具、项目管理、工程与社会、环境和可持续发展、职业规范、个人和团队、终身学习。

毕业能力要求及其指标点分解：

毕业能力要求	指标点
毕业要求 1： 工程知识：掌握本专业所需的数学、自然科学知识和大数据学科知识，并能用于解决大数据领域的复杂工程问题。	1-1.掌握数学、自然科学和大数据学科的基础知识，用于表述实际问题；
	1-2.掌握数学、自然科学和大数据学科知识和原理，用于建立实际问题的数学模型；
	1-3.运用数据科学与大数据技术的专业知识和原理，进行大数据系统的分析与设计；
	1-4.将大数据学科专业知识和原理用于建立大数据领域复杂工程问题的解决方案；
毕业要求 2： 问题分析：能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究分析大数据领域复杂工程问题，以获得有效结论。	2-1.能够运用数学、自然科学和专业基础知识，识别和判断大数据领域复杂工程问题；
	2-2.能够基于数学、自然科学和专业基础知识，表达大数据领域复杂工程问题；
	2-3.能够认识到解决问题有多种方案，寻求可替代的解决方案；
	2-4.通过文献研究，给出大数据领域复杂工程问题的解决方案；
毕业要求 3： 问题研究：能够基于科学原理并采用科	3-1.基于大数据科学原理，能够利用文献资料，针对大数据领域复杂工程问题建立相应数学模型，并符合系统开发和工程化的基本要求；

<p>学方法对大数据领域复杂工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。</p>	<p>3-2.针对数学模型，提出自己的研究思路和想法，设计出切实可行的模拟或实验方案；</p> <p>3-3.能够依据实验方案开展实验，对实验数据进行分析 and 解释、并通过信息综合得到合理有效的结论；</p>
<p>毕业要求 4： 设计解决方案：能够设计针对大数据领域复杂工程问题的解决方案，设计满足特定需求的系统、单元或流程，并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素。</p>	<p>4-1.掌握大数据领域内工程设计和产品开发全周期、全流程的基本设计/开发方法和技术；</p> <p>4-2.能够针对大数据领域内的特定需求，完成应用系统的设计，并能在设计中体现创新意识；</p> <p>4-3.在设计中能够考虑安全、法律、文化以及环境等制约因素；</p>
<p>毕业要求 5： 使用现代工具：能够针对大数据领域复杂工程问题，开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具，包括对复杂大数据工程及其相关领域问题的预测与模拟，并能够理解其局限性。</p>	<p>5-1.了解常用开发环境及开发工具的性能、适应范围以及对开发、分析的适应性，并能正确应用；</p> <p>5-2.针对具体的对象，能够选择并使用恰当的开发工具进行设计、计算和分析，并能够理解其局限性；</p> <p>5-3.能够针对大数据领域复杂工程问题，选用满足特定需求的现代工具，模拟大数据领域的专业问题；</p>
<p>毕业要求 6： 工程与社会：能够基于大数据领域相关背景知识进行合理分析，评价大数据工程实践和大数据领域复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。</p>	<p>6-1.能够了解大数据专业领域工程实训需要具备的相关能力；</p> <p>6-2.了解大数据领域相关背景知识和技术标准体系；了解与大数据领域相关的法律、法规和产业政策；</p> <p>6-3.能够评价大数据工程实践对于社会、安全、法律和文化的可能影响，并理解应承担的责任；</p>
<p>毕业要求 7： 环境和可持续发展：能够理解和评价针对大数据领域复杂工程问题的工程实践对环境、社会可持续发展的影响。</p>	<p>7-1.具有环境保护的自觉和可持续发展的意识；了解环境保护与可持续发展相关的方针与政策、法律与法规；</p> <p>7-2.能够理解实际解决方案和工程实践的可持续性，理解和评价大数据领域复杂工程问题的解决方案和大数据工程实践对环境、社会可持续发展的影响；</p>
<p>毕业要求 8： 职业规范：具有人文社会科学素养、社会责任感，能够在工程实践中理解并遵守工程职业道德和规范，履行责任。</p>	<p>8-1.具有基本的人文社会素养，树立和践行社会主义核心价值观，能够运用历史、哲学的知识和方法认识、分析社会现象，理解个人与社会的关系，了解中国国情，确个人作为社会主义事业建设者和接班人所肩负的责任和使命；</p> <p>8-2.能够拥有健康的体质，具有正确的价值观，具有良好的心理素质和社会责任感；</p> <p>8-3.理解诚实公正、诚实守信的大数据领域的工程职业道德和规范，并能自觉遵守，理解大数据领域工程师对公众的社会责任；</p>
<p>毕业要求 9： 个人和团队：能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。</p>	<p>9-1.在多学科背景下明确团队的角色构成和职责分工，能够具有团队合作意识，能够提出自己的想法并且倾听其他成员的意见和建议；</p> <p>9-2.能够与团队其他成员有效沟通，能够在团队中承担个体、团队成员以及负责人的角色，并完成团队分配的任务；</p>
<p>毕业要求 10： 沟通：能够就大数据领域复杂工程问题与业界同行及社会公众进行有效沟通和交流，包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。并具备一定的国际视野，能够在跨文化背景下</p>	<p>10-1.能够将大数据领域复杂工程问题用文稿或图纸等技术文件进行清晰表达；</p> <p>10-2.能够通过文稿或图纸等技术文件及利用现代信息技术与业界同行及社会公众就大数据领域复杂工程问题进行沟通交流；</p> <p>10-3.了解数据科学与大数据技术专业相关行业的热点问题与国际状况；</p>



进行沟通和交流。	10-4.具备一门外国语的基本听、说、读、写、译能力，能够阅读专业领域的外文资料，能够在跨文化背景下进行沟通和交流；
毕业要求 11： 项目管理：理解并掌握大数据工程及其相关领域中工程管理原理与经济决策方法，并能在多学科环境中应用。	11-1.能够理解和掌握大数据工程的管理原理和经济决策方法；
	11-2.能够在解决大数据工程方案设计过程中，运用工程管理和经济决策的方法；
毕业要求 12： 终身学习：具有自主学习和终身学习的意识，有不断学习和适应发展的能力。	12-1.具有自主学习和终身学习意识；
	12-2.具有自主学习的能力，包括对技术问题的理解能力、归纳总结的能力和解决问题的能力；

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。

### 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标				
	培养目标 1	培养目标 2	培养目标 3	培养目标 4	培养目标 5
1: 工程知识		√	√		
2: 问题分析	√	√	√		
3: 问题研究	√		√	√	
4: 设计解决方案		√	√	√	
5: 使用现代工具		√	√	√	
6: 工程与社会	√		√		
7: 环境和可持续发展	√			√	
8: 职业规范	√				√
9: 个人和团队	√		√		√
10: 沟通	√		√	√	√
11: 项目管理	√				√
12: 终身学习		√	√	√	√

#### 四、主干学科

计算机科学与技术

#### 五、专业核心课程

程序设计基础、算法与数据结构、离散数学、Python 语言、数据库系统原理、多元统计分析、操作系统基础及 Linux、并行计算与分布式系统、机器学习基础、大数据平台与存储技术、大数据计算与分析。

#### 六、修业年限

本科基本学制 4 年，弹性学习年限 3-6 年，按照学分管理制度管理。

#### 七、授予学位

学生应至少修满 169 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者，可授予工学学士学位。

## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例(%)
通识教育课	通识教育必修课	思政类	必修	17	39	23.08
		外语类		12		
		军事安全类		2		
		劳动体育类		5		
		创新创业类		2		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	1	8	4.73
		中国与世界(500)		1		
		四史(600)		1		
		经济管理类(700)		2		
		科学技术类(800)		1		
传统文化(900)		2				
通识教育实践课	军训	实践	2	2	1.18	
学科平台课	学科基础课程	公共基础类	必修	67.5	67.5	70.01
		专业基础类				
	学科实践课程	-	实践			
专业教育课	专业核心课程	-	必修	23.5	47.5	
	专业选修课程	-	选修	2		
	专业实践课程	-	实践	22		
能力拓展课	专业特色课程	-	必修(或实践)	5	5	
课外环节	课外通识实践	人文社会实践	课外实践	4		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
	生涯教育	成长规划类		1		
总学分/比例					169	100%

# Data Science and Big Data Technology Major 2021 Undergraduate Education Program

## I. Educational Objectives

This major aims to cultivate students with noble moral quality, good professional quality and sense of social responsibility, adapts to the development of big data technology, meets the needs of industry and regional economic construction, has solid professional and technical basic knowledge. High-level talents who can engage in big data research, product development, application system development, implementation and maintenance in related fields such as big data platform construction, big data storage and management, big data computing, big data analysis and visualization.

Graduates should obtain knowledge and competences as follows:

(1) Comprehensively consider social, legal, safety, environmental and sustainability factors, reflect a high sense of social responsibility and engineering ethics, and have the willingness and ability to serve the society in social activities.

(2) Be able to use relevant knowledge and technology in accordance with big data engineering technical specifications in the actual environment of enterprises and society, and have the ability of technical research, product development, application development and system implementation and maintenance.

(3) Possess a certain R & D spirit and innovation consciousness in the fields of big data new products, new technologies and new applications, and have the ability to actively seek and acquire new knowledge and new technologies, according to the needs of big data technology development and social development.

(4) Be able to skillfully use foreign language and computer related tools in social environment, and effectively communicate with domestic and foreign peers on big data system development, product development, new knowledge and new technology, etc.

(5) Effectively play an important role in the team composed of multi-role personnel, and then manage multi-disciplinary projects from a systematic perspective.

## II. Major direction

Big data analysis and processing

## III. Graduation Requirements

Graduates should obtain knowledge and competences as follows:

Graduation Requirements	Indices
Requirement 1: Engineering knowledge: master the knowledge of mathematics, natural science and big data required by the	1-1. Master the basic knowledge of mathematics, natural science and big data to express practical problems;
	1-2. Master the knowledge and principles of mathematics, natural science and big data, and use them to establish mathematical models of practical problems;

major, and be able to solve complex engineering problems in the field of big data.	1-3. Use the professional knowledge and principles of data science and big data technology to analyze and design the big data system;
Requirement 2: Problem analysis: be able to apply the basic principles of mathematics, natural science and engineering science to identify, express and analyze complex engineering problems in big data field through literature research, so as to obtain effective conclusions.	2-1. Be able to use mathematics, natural science and professional knowledge to identify and judge complex engineering problems in big data field;
	2-2. Be able to express complex engineering problems in big data field based on mathematics, natural science and professional knowledge;
	2-3. Be able to recognize that there are many solutions to problems and seek alternative solutions;
	2-4. Through literature research, solutions to complex engineering problems in the field of big data are given.
Requirement 3: Problem research: be able to research complex engineering problems in big data field based on scientific principles and scientific methods, including designing experiments, analyzing and interpreting data, and getting reasonable and effective conclusions through information synthesis.	3-1. Based on the scientific principle of big data and through literature, establish corresponding mathematical models for complex engineering problems in the field of big data, and meet the basic requirements of system development and engineering;
	3-2. Put forward their own research thoughts and ideas according to the mathematical model,, design a practical simulation or experimental program;
	3-3. Be able to carry out experiments according to the experimental scheme, analyze and interpret the experimental data, and make reasonable and effective conclusions through information synthesis.
Requirement 4: Design solutions: be able to design solutions for complex engineering problems in the field of big data, design systems, units or processes that meet specific needs, and reflect the sense of innovation in the design process, taking into account social, health, safety, legal, cultural and environmental factors.	4-1. Master the basic design / development methods and technologies of the whole cycle and process of engineering design and product development in the field of big data;
	4-2. Be able to complete the design of the application system according to the specific needs in the field of big data, and embody the sense of innovation in the design;
	4-3. Consider safety, law, culture and environment in the design.
Requirement 5: Use of modern tools: be able to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for complex engineering problems in big data field, including prediction and Simulation of complex big data engineering and related fields, and be able to understand its limitations.	5-1. Understand the performance and adaptability of common development environment and development tools, as well as their adaptability to development and analysis, and be able to apply them correctly;
	5-2. Be able to select and use appropriate development tools to design, calculate and analyze specific objects, and understand their limitations;
	5-3. Be able to select modern tools to meet specific needs and simulate professional problems in big data field for complex engineering problems in big data field.
Requirement 6: Engineering and society: be able to conduct reasonable analysis based on	6-1. Be able to understand the relevact abilities required for engineering training in the field of big data engineering;

the relevant background knowledge in the field of big data, evaluate the impact of big data engineering practice and solutions to complex engineering problems in the field of big data on society, health, safety, law and culture, and understand the responsibilities to be undertaken.	6-2. Understand the relevant background knowledge and technical standard system in the field of big data; understand the laws, regulations and industrial policies related to big data;
	6-3. Be able to evaluate the possible impact of big data engineering practice on society, security, law and culture, and understand the responsibilities.
Requirement 7: Environment and sustainable development: be able to understand and evaluate the impact of engineering practice for complex engineering problems in the field of big data on environmental and social sustainable development.	7-1. Have the consciousness of environmental protection and sustainable development; understand the guidelines and policies, laws and regulations related to environmental protection and sustainable development;
	7-2. Be able to understand the sustainability of practical solutions and engineering practices, and understand and evaluate the impact of solutions to complex engineering problems in big data field and big data engineering practices on environmental and social sustainable development.
Requirement 8: Professional norms: have humanities and social science literacy, sense of social responsibility, be able to understand and abide by engineering professional ethics and norms in engineering practice, and fulfill responsibilities.	8-1. Have basic humanities and social literacy, establish and practice socialist core values; be able to use historical and philosophical knowledge and methods to understand and analyze social phenomena, understand the relationship between individuals and society, understand China's national conditions, and ensure the responsibility and mission of individuals as builders and successors of the socialist cause.
	8-2. Be able to have healthy constitution, correct values, good psychological quality and sense of social responsibility.
	8-3. Understand such engineering professional ethics and norms as honesty and integrity, honesty and trustworthiness in the field of big data, and consciously abide by them, and
Requirement 9: Individual and team: be able to play the role of individual, team member and leader in a multidisciplinary team.	9-1. Clarify team roles and responsibilities in the multi-disciplinary background, have a sense of teamwork, put forward their own ideas and listen to the opinions and suggestions of other members;
	9-2. Be able to communicate with other team members effectively, take the role of individual, team member and leader in the team, and complete the tasks assigned by the team.
Requirement 10: Communication: be able to effectively communicate with peers in the industry and the public on complex engineering problems in the big data field, including writing reports and design manuscripts, making statements, clearly expressing or responding to instructions. And have a certain international vision, be able to communicate and exchange in the cross-cultural background.	10-1. Be able to clearly express complex engineering problems in big data field with technical documents such as manuscripts or drawings;
	10-2. Be able to communicate with peers in the industry and the public on complex engineering problems in the field of big data through technical documents such as manuscripts or drawings and the use of modern information technology;
	10-3. Understand the hot issues and international situation of data science and big data technology related industries;
	10-4. Have basic listening, speaking, reading, writing and translation skills in a foreign language, be able to read foreign language materials in professional fields, and be able to communicate and communicate in a cross-cultural context.

Requirement 11: Project management: understand and master the engineering management principles and economic decision-making methods in big data engineering and its related fields, and be able to apply them in a multidisciplinary environment.	11-1. Be able to understand and master the management principles and economic decision-making methods of big data engineering;
	11-2. Be able to use engineering management and economic decision-making methods in the process of solving big data engineering scheme design;
Requirement 12: Lifelong learning: have the consciousness of self-learning and lifelong learning, have the ability of continuous learning and adapting to development.	12-1. Have the consciousness of self-learning and lifelong learning;
	12-2. Have the ability of autonomous learning, including the ability to understand technical problems, the ability to summarize and solve problems.

### The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives				
	Educational Objectives 1	Educational Objectives 2	Educational Objectives 3	Educational Objectives 4	Educational Objectives 5
1: Engineering Knowledge		√	√		
2: Problem Analysis	√	√	√		
3: Research	√		√	√	
4: Design/Development Solutions		√	√	√	
5: Use Modern Tools		√	√	√	
6: Engineering and Society	√		√		
7: Environment and Sustainable Development	√			√	
8: Career Planning	√				√
9: Individuals and Teams	√		√		√
10: Communication	√		√	√	√
11: Project Management	√				√
12: Lifelong Learning		√	√	√	√

#### IV. Major Subject

Computer science and technology

#### V. Core Courses

Programming basis, algorithm and data structure, discrete mathematics, python language, database system principle, multivariate statistical analysis, operating system basis and Linux, parallel computing and distributed system, machine learning basis, big data platform and storage technology, big data computing and analysis.

## **VI. Educational System**

The basic length of undergraduate education is 4 years, and the flexible study period is 3-6 years. It is managed according to the credit system.

## **VII. Confer Degrees**

Students should complete at least 169 credits before graduation. The Bachelor of engineering degree can be granted to those who meet the degree awarding requirements of the relevant regulations on the awarding of bachelor's degree for graduates of Shenyang University of Chemical Technology (revised in March 2017).



## VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit requirement	Subtotal	Proportion (%)
General Education	General Education (Compulsory)	Ideological and Political Courses	Compulsory	17	39	23.08
		Foreign Language Courses		12		
		Military and Safety Courses		2		
		Labor and Sport Education		5		
		Innovation and Entrepreneurship		2		
		Mental Health		1		
	General Education (Optional)	Aesthetic Education(400)	Optional	1	8	4.73
		China and the world(500)		1		
		Four Histories(600)		1		
		Economic Management (700)		2		
		Science and echnology (800)		1		
		Traditional ulture(900)		2		
	General education practice course	Military Training	Practice	2	2	1.18
Discipline Education	Basic Courses	Public Basic Class	Compulsory	67.5	67.5	71.01
		Professional Foundation				
	Basic Practice Sessions	-	Practice			
Specialized Education	Core Courses	-	Compulsory	23.5	47.5	71.01
	Optional Courses	-	Optional	2		
	Specialized Practice Sessions	-	Practice	22		
Competency Development	Individualized Courses	-	Compulsory (or Practice)	5	5	
Extracurricular links	Extracurricular General Education Practice	Culture and Society Practice	Extracurricular Practice	4		
		Mentally and Physically Practice				
		Foreign Language Proficiency Training Practice				
	Extracurricular Characteristic Practice	Innovative Training		4		
		Innovation Competition				
		Chuangke Activities				
	Career Education	Growth Planning Courses		1		
Total/Proportion					169	100%

## 九、数据科学与大数据技术专业教学进程表

### Table of Teaching Schedule for Data Science and Big Data Technology Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C. H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
通识教育课 General Education	必修 Compulsory	思政类 Ideological and Political Courses	0710093001	思想道德与法治    Ideological Morality and the Rule of Law	3.0	48	32			16		2								
			0710053001	中国近现代史纲要   Outline of Chinese Contemporary and Modern History	3.0	48	32			16	2									
			0710103001	马克思主义基本原理*   Elementary Theory of Marxism*	3.0	48	32			16			2							
			0710123001	习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8					3					
			0710133001	毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3.0	48	32			16				2						
			0710012301	形势与政策   Current Situation and Policies	2.0	64	64					1	1	1	1	1	1	1	1	
	外语类 Foreign Language Courses	0211003101	大学外语I   College English I	3.0	48					3										
		0211003201	大学外语II   College English II	3.0	48						3									
		0241003301	大学外语III   College English III	3.0	48								3						五选一	

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C. H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八	
											1st	2nd	3rd	4th	5th	6th	7th	8th	
通识教育课 General Education	必修 Compulsory	外语类 Foreign Language Courses	0241003401	大学外语III（进阶英语）    College English III（Advanced English CET 6-Orientated）	3.0	48													五选一
				大学外语III（英语口语表达与交流）    College English III（English Oral Expression and Communication）	3.0	48													
				大学外语III（跨文化交际）    College English III（Intercultural Communication）	3.0	48													
				大学外语III（英语写作表达与交流）    College English III(English Writing Expression and Communication）	3.0	48													
			0241003401	大学外语IV*   College English IV*	3.0	48													
				大学外语IV（进阶英语）    College EnglishIV（Advanced English CET 6-Orientated）	3.0	48													
				大学外语IV（英语口语表达与交流）    College EnglishIV（English Oral Expression and Communication）	3.0	48					3								
				大学外语IV（跨文化交际）    College English IV（Intercultural Communication）	3.0	48													
				大学外语IV（英语写作表达与交流）    College English IV（English Writing Expression and Communication）	3.0	48													



课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C. H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八	
											1st	2nd	3rd	4th	5th	6th	7th	8th	
	实践 Practice		0415102011	军训   Military Training	2.0	48				48	+2								集中
合计 Total					49.0														
学科平台课 Discipline Education	必修 Compulsory	数学与自然科学类 Natural Science & Mathematics	0310004101	高等数学 I*   Advanced Mathematics I*	4.5	80	72			8	6								
			0310005201	高等数学 II*   Advanced Mathematics II*	5.5	96	88			8	6								
			0310063001	大学物理*   University Physics*	3.0	48	48				3								
			0310034001	线性代数   Linear Algebra	4.0	64	64					4							
			0317184001	概率论与数理统计   Probability and Statistics	4.0	64	64						4						
			1610063002	离散数学*   Discrete Mathematics*	3.0	48	48				3								
			1614613002	多元统计分析*   Multivariate Statistical Analysis*	2.5	44	32	12						2					
			1610713002	数学模型   Mathematical Model	3.0	48	48								3				
		1610052002	计算机科学导论   Introduction to Computer Science	2	32	32				2									
		1612021002	工程导论    Introduction to Engineering	1.0	16	16				2									
1612051002	文献检索与科技论文写作   Document Retrieval and Scientific Paper Writing	1.0	18	12		6				2									

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C. H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八			
											1st	2nd	3rd	4th	5th	6th	7th	8th			
学科平台课 Discipline Education	必修 Compulsory	专业基础类 Subject Foundation Requisite	1617012002	计算机学科专业外语   English for Computer Specialty	2.0	32	32							2							
			1616023002	程序设计基础 I*   Fundamentals of Programming I*	3.0	56	32	24			2										
			1616403002	程序设计基础II*   Fundamentals of Programming II*	3.0	56	32	24				2									
			1610992002	Java 语言程序设计   Java Language Programming	2.5	40	40								3						
			1616413002	操作系统基础及 Linux*   Operating System foundation and Linux*	3.0	52	40	12								3					
			1610083002	算法与数据结构*   Algorithm and Data Structures*	3.0	52	40	12						3							
			1610093002	计算机组成原理*   Computer Organization and Architecture*	3.0	52	40	12							3						
			1610123002	数据库系统原理*   Principle of Database System*	3.0	52	40	12							3						
			1610142002	计算机网络*   Computer Networking*	2.5	44	32	12							2						
			1610152002	软件工程*   Software Engineering*	2.5	40	40									3					
			1644270002	学业与专业教育   Academic and Professional Education	0.5	8	8					2									
	小计 Subtotal					61.5	1042.0	900.0	120.0	6.0	16.0										
	实践 Practice		0310081011	大学物理实验    College Physical Experiment	1.0	24	6	18					4								

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C. H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
										1st	2nd	3rd	4th	5th	6th	7th	8th		
学科平台课 Discipline Education	实践 Practice	1610031011	计算机应用实践   Computer Application Practice	1.0	24					2									
		1614701022	程序设计基础实践   Practices for Programming Fundamentals	1.5	36		36				2								
		1613721002	数据库应用系统开发实践    Development Practice of Database Application System	1.0	24		24							2					
		1615351022	Java 语言实践   Practices for Java Language	1.5	36		36						2						
		小计 Subtotal			6.0	144.0	6.0	114.0	0.0	0.0									
		合计 Total			67.5	1186.0	906.0	234.0	6.0	16.0									
专业教育课 Specialized Education	必修 Compulsory	1620393002	运筹学   Operations Research	3.0	48	48										3			
		1616103002	机器学习基础*   Fundamentals of Machine Learning*	3.0	56	32	24									2			
		1614622002	并行计算与分布式系统*   Parallel Computing and Distributed System*	2.0	36	24	12							2					
		1620223002	信息系统原理*   Principles of Information System*	3.0	48	48										3			
		1614643002	数值计算方法*   Numerical Calculation Method*	3.0	52	40	12							3					
		1624652002	Python 语言程序设计   Python Language Programming	2.0	32	32						2							
		1614662002	大数据平台与存储技术*   Big Data Platform and Storage Technology*	2.5	40	40								3					





课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C. H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th		
专业教育课 Specialized Educatio	实践 Practice		选修课修满 2 学分 Professional elective credits must be more than 2 credits																	
			1617031042	毕业设计（论文）   Graduation Design (Thesis)	14	336													+14	
			1614691022	Python 语言实践   Practices for Python Language	1.5	36		36					2							
			1616371022	大数据计算与分析工程实践   Big Data Computing and Analysis Engineering Practice	1.5	36										2				
			1614501022	大数据平台工程实践   Engineering Practice of Big Data Platform	1.5	36									2					
			1614512022	大数据系统开发与设计工程实践   Big data system development and design engineering practice	1.5	36										2				
			1615232032	生产实习   Production Practice	2.0	48		48											+2	
			小计 Subtotal		22	528	0	84	0	0										
合计 Total		47.5	924.0	336.0	144.0	0.0	0.0													
能力拓展课 Competency Development	必修或实践 Compulsory or Practice		1617045022	学科特色实践   Discipline Characteristic Practice	5	120		120									12			
			小计 Subtotal		5															
			本模块为必修实践环节 This module is a required practice																	
总计 Sum					69.0	3070	1530	522	6	128	23	25	19.5	25.5	25	27	8	16		
	课外实践 Extracurricular practice	人文社会实践 Culture and Society Practice	1614010012	社会调查   Social Survey	0.5	12				12								0.5	分散 dispersed	

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C. H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
课外环节 Extracurricular	课外实践 Extracurricular practice	身心健康社会实践 Mentally and Physically Practice	0410050751	课外体育锻炼   Extracurricular Physical Exercise	0.5	12				12							0.5	分散 dispersed		
			2640030011	劳动教育实践   Labour Education Practice	0.5	12				12		0.5						分散 dispersed		
			0510070311	心理健康辅导   Mental Health Counseling	0.5	12				12							0.5	分散 dispersed		
		外语技能实践类 Foreign Language Proficiency Training Practice	0210010011	外语技能实践（初级）   Foreign Language Proficiency Training Practice (elementary)	2.0	48				48				2						二选一 Select from one
			0210020011	外语技能实践（高级）   Foreign Language Proficiency Training Practice (advanced)																
				能力与创新实践 Capability and Innovation Practice	1615494011	大学生素质拓展与创新实践   Quality Development and Innovation Practice	4.0	96				96	1~8 学期依据《沈阳化工大学创新创业实践学分认定办法》由创新创业学院认定 Semester 1 ~ 8 will be recognized by The School of Innovation and Entrepreneurship according to the Measures for Recognition of Innovation and Entrepreneurship Practice Credits of Shenyang University of Chemical Technology							
		成长规划类 Growth Planning Courses	1617601301	职业规划与就业指导   Career Planning and Employment Guidance	1.0	40	40				1						1			
小计 Subtotal																				

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5,课程名称中画\*为考试课。

One credit of theory course is 16 hours; one credit of experiment course and computer course is 24 hours; one credit of PE course is 36 hours; one teaching week of centralized practice course is 1 credit; and the minimum unit of credit is 0.5. Drawing \* in the course name is the examination course.

Note: "Cre. (Credits)", "T.C.H. (Total Credit Hours)", "Lec. (Lecture)", "Exp. (Experiment)", "Pro. (Programming)", "Pra. (Practice)".

## 十、数据科学与大数据技术专业学士学位课程一览表

### A List of Bachelor's Degree Programs in Data Science and Big Data Technology

课程类别 Course Type	模块名称 Modules	序号 No.	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester	
通识教育课 General Education	思政类 Ideological and Political Courses	1	0710103001	马克思主义基本原理 Elementary Theory of Marxism	3	3	
		2	0710133001	毛泽东思想和中国特色社会主义 理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3	4	
学科平台课 Discipline Education	数学与自然科 学类 Natural Science & Mathematics	3	0310014101	高等数学I* Advanced Mathematics I*	4.5	1	
		4	1610063002	离散数学* Discrete Mathematics*	3	2	
		5	1614613002	多元统计分析* Multivariate Statistical Analysis*	2.5	5	
	专业基础 Subject Foundation Requisite	6	1616023002	程序设计基础I* Fundamentals of Programming I*	3	1	
		7	1610083002	算法与数据结构* Algorithm and Data Structures*	3	3	
		8	1610123002	数据库系统原理* Principle of Database System	3	4	
		9	1610142002	计算机网络* Computer Networking*	2.5	4	
	专业教育课 Specialized Education	必修 Compulsory	10	1624652002	Python 语言程序设计 Python language Programming	2	3
			11	1616103002	机器学习基础* Fundamentals of machine learning*	3	6
12			1614622002	并行计算与分布式系统* Parallel Computing and Distributed System*	2	5	
13			1614662002	大数据平台与存储技术* Big Data Platform and Storage Technology*	2.5	5	
14			1616152002	大数据计算与分析* Big Data Calculation and Analysis*	2	6	

### 十一、全学程实践环节周历安排 Weekly Calendar of all Practice Sessions

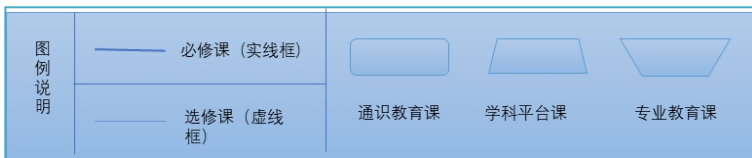
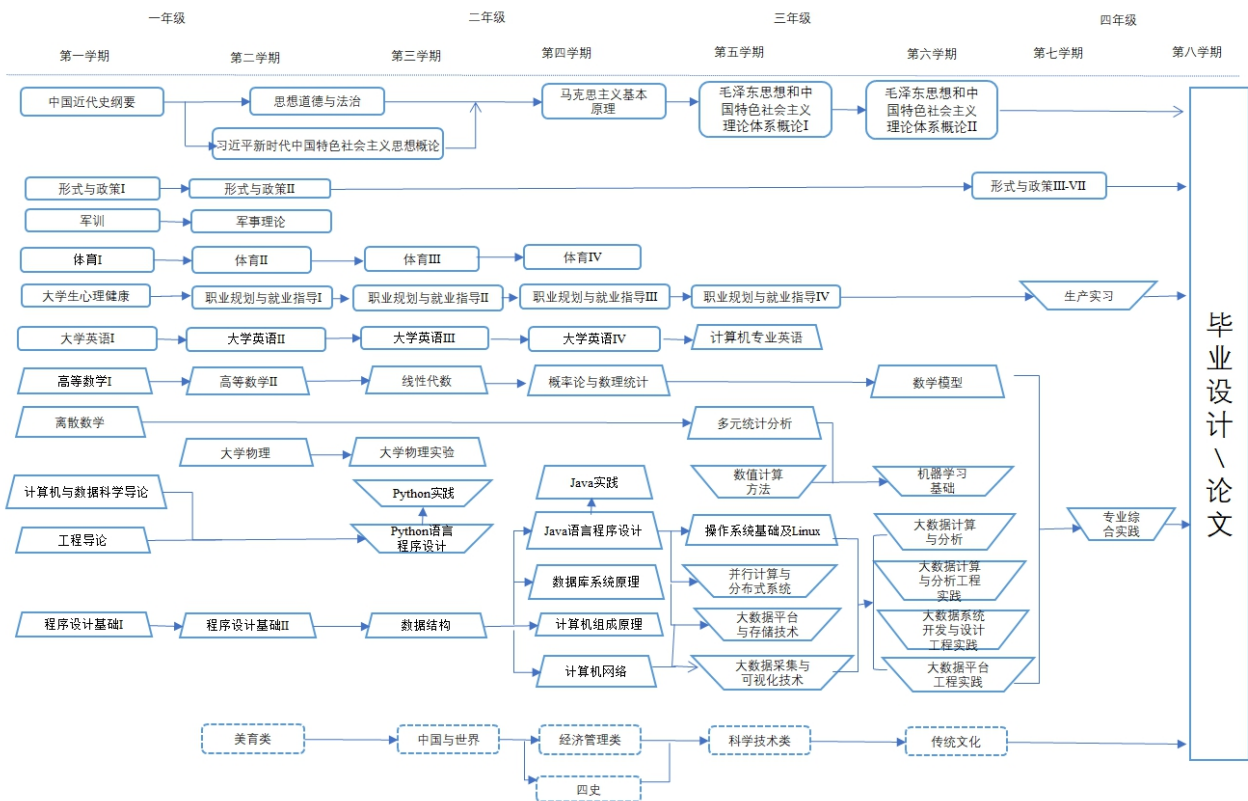
学期 Semesters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注
一		☆	☆															::	::	·		
二																		::	::	·		
三																		::	::	·		
四																		::	::	·		
五																		::	::	·		
六																		::	::	·		
七	P	P	P	P	P	P	/	/										::	::	·		
八	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=					

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符号说明(Symbol Description):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P 各类实训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计(论文)  
||Graduation Project(Thesis)    ·小学期||Primary Term

## 十二、课程体系配置图 Curriculum System Configuration Diagram



十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements (High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																				
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	12.2		
马克思主义基本原理*   Basic Principles of Marxism*																							L	H													
中国近现代史纲要   Outline of Chinese Contemporary and Modern History																				M			H														
思想道德与法治   Ideological Morality and the Rule of Law														M					H		H				H												
习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																							M	H													
毛泽东思想和中国特色社会主义理论体系概论   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics																							M	H													
形势与政策   Current Situation and Policies												H		L					H		M		H														
大学外语I-IV   College English I-IV																																			H		
大学体育I-IV   College Physical EducationI-IV																									H		M										

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																					
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	12.2			
高等数学*   Advanced Mathematics I-II*	H	M				M																																
线性代数   Linear Algebra		H				M																																
概率论与数理统计   Probability and Statistics		H				M																																
大学物理*   University Physics*	H					L																																
离散数学*   Discrete Mathematics*	H				H																																	
工程导论    Introduction to Engineering														H						H	H					M	H											
计算机科学导论   Introduction to Computer Science														H						H	H		M	L						H								
计算机学科专业外语   English for Computer Specialty																					L											H						
计算机组成原理**   Computer Organization and Architecture*					H	M								H																								
计算机网络*   Computer Networking*				H										H					M																			
高等数学 I*、II*   Advanced Mathematics I* II*	H	M				M																																
操作系统基础及 Linux   Operating system foundation and Linux*					H	H								H																								
算法与数据结构*   Algorithm and Data Structures*		H	M			H								H																								
数值计算方法**   Numerical calculation method*	H	H			H									H	M																							

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																				
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	12.2		
数据库系统原理*   Principle of Database System*			M			H																															
程序设计基础I*   Fundamentals of Programming I*			H													H																					
程序设计基础II*   Fundamentals of Programming II*			H	M			H																														
文献检索与科技论文写作   Document Retrieval and Scientific Paper Writing								M								M	M													H							
PYTHON 语言程序设计   Python Language Programming							H			H		M	M				H																				
Java 语言程序设计   Java Language Programming			H													H																					
多元统计分析**   Multivariate Statistical Analysis*	H		H	H	L	M																															
机器学习基础*   Fundamentals of Machine Learning*						M				H			H				L	L																			
并行计算与分布式系统*   Parallel Computing and Distributed System*				H			M											H																			
大数据平台与存储技术*   Big Data Platform and Storage Technology*			H				M					M	L																								
大数据计算与分析*   Big Data Calculation and Analysis*			H	H					H		H				M	H	H																				
大数据系统开发与设计*   Big Data Calculation and Analysis*				H			H	H			H		H	L																							



课程 (Courses)	毕业能力要求 (Graduation Requirements)																																				
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	12.2		
专业综合实践   Professional Comprehensive Practice													H					H									M		L	L							
信息系统原理*   Principles of information system*																																	H	H			
学业与专业教育 Academic and professional education																			M							H										H	
毕业设计(论文) Graduation Design (Thesis)											M			H			H										M		H						H	H	H
职业规划与就业指导   Career Planning and Employment Guidance																										H	H	L									

# 沈阳化工大学专升本培养方案

## 计算机科学与技术学院

专业名称：计算机科学与技术

专业代码：080901

制 定：张 雪

审 核：张 波

审 定：于三三

批 准：金志浩

2021年8月

# 计算机科学与技术专业（专升本）培养方案

## 一、培养目标

本专业培养具有高尚的道德品质、良好职业素养和社会责任感，适应辽宁经济建设和我国 IT 行业发展需求，为社会主义建设服务，能够运用数学、自然科学和计算机科学的基础知识，在计算机软件、大数据处理、物联网工程等相关领域从事技术研究、产品研发、应用开发和系统实施与维护工作，胜任企事业单位技术或管理骨干的有特色的高素质应用型人才。

本专业毕业生具有如下目标预测：

- （1）能在社会活动中，综合考虑社会、法律、安全、环境及可持续性等因素，体现高度的社会责任感和工程职业道德，具有服务社会的意愿和能力。
- （2）能够在企业和社会实际环境中，具有按照计算机工程技术规范运用相关知识和技术进行技术研究、产品研发、应用开发和系统实施与维护等能力。
- （3）能够根据 IT 技术发展和社会发展需求，在计算机新产品、新技术等领域，具有研发精神和创新意识，具有积极寻求和获取新知识与新技术的能力。
- （4）能够在社会环境中，熟练运用外语与计算机相关工具，就软硬件系统开发、产品研发、新知识新技术等环节，与国内外同行进行有效沟通。
- （5）能在多角色人员构成的团队中，有效地发挥重要作用，进而从系统的视角管理多学科组成的项目。

## 二、专业方向

计算机科学与技术

## 三、毕业要求

计算机科学与技术专业对学生的毕业要求为 12 条，并对每一个毕业要求指标点进行分解，分别如下：

- 1.工程知识：掌握数学、自然科学知识和计算机学科知识，并能用于解决计算机软件、大数据处理、物联网工程等相关领域的复杂工程问题。
- 2.问题分析：能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究分析计算机软件、大数据处理、物联网工程等相关领域复杂工程问题，以获得有效结论。
- 3.设计/开发解决方案：能够设计针对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题的解决方案，设计满足特定需求的系统、单元（部件）或工艺流程，并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素。
- 4.研究：能够基于科学原理并采用科学方法对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。

5.使用现代工具：能够针对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题，开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具，包括对复杂计算机工程及其相关领域问题的预测与模拟，并能够理解其局限性。

6.工程与社会：能够基于计算机软件、大数据处理、物联网工程等相关领域相关背景知识进行合理分析，评价计算机专业工程实践和计算机软件、大数据处理、物联网工程等相关领域复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。

7.环境和可持续发展：能够理解和评价针对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题的工程实践对环境、社会可持续发展的影响。

8.职业规范：具有人文社会科学素养、社会责任感，能够在工程实践中理解并遵守工程职业道德和规范，履行责任。

9.个人和团队：能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。

10.沟通：能够就计算机软件、大数据处理、物联网工程等相关领域复杂工程问题与业界同行及社会公众进行有效沟通和交流，包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。并具备国际视野，能够在跨文化背景下进行沟通和交流。

11.项目管理：理解并掌握计算机软件、大数据处理、物联网工程等相关领域中工程管理原理与经济决策方法，并能在多学科环境中应用。

12.终身学习：具有自主学习和终身学习的意识，有不断学习和适应发展的能力。

毕业能力要求及其指标点分解：

毕业能力要求	指标点
毕业要求 1： 工程知识 掌握数学、自然科学知识和计算机学科知识，并能用于解决计算机软件、大数据处理、物联网工程等相关领域的复杂工程问题。	1-1.掌握数学、自然科学和计算机学科的基础知识，用于表述实际问题的数学模型
	1-2.掌握数学、自然科学和计算机学科的知识 and 原理，用于建立实际问题的数学模型
	1-3.运用计算机学科的专业知识和原理，依据建立的数学模型，进行计算机软硬件系统的单元分析与设计
	1-4.将计算机学科的专业知识和原理用于建立实际问题的解决方案
毕业要求 2： 问题分析 能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究分析计算机软件、大数据处理、物联网工程等相关领域复杂工程问题，以获得有效结论	2-1.能够运用数学、自然科学和专业 知识，识别和判断计算机软件、大数据处理、物联网工程等相关领域复杂工程问题
	2-2.能够基于数学、自然科学和专业 知识，表达计算机软件、大数据处理、物联网工程等相关领域复杂工程问题
	2-3.认识到解决问题有多种方案，寻求可替代的解决方案
	2-4.通过文献研究，分析和筛选出计算机软件、大数据处理、物联网工程等相关领域复杂工程问题的解决方案
毕业要求 3： 设计解决方案 能够设计针对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题的解决方案，设计满足特定需求的系统、单元（部件）或工艺流程，并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素	3-1.掌握计算机软件、大数据处理、物联网工程等相关领域内工程设计和产品开发全周期、全流程的基本设计/开发方法和技术
	3-2.能够针对计算机软件、大数据处理、物联网工程等相关领域内的特定需求，完成计算机软、硬件系统单元的设计，并能在设计中体现创新意识
	3-3.在设计中能够考虑安全、法律、文化以及环境等制约因素
毕业要求 4： 问题研究 能够基于科学原理并采用科学方法对计算机软件、大	4-1.基于计算机科学原理，能够利用文献资料，针对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题建立相应研究模型，并符合系统开发和工程化的基本要求

数据处理、物联网工程等相关领域复杂工程问题进行研究,包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论	4-2. 针对研究模型,提出自己的研究思路和想法,设计出切实可行的模拟或实验方案
	4-3. 能够依据实验方案开展实验,对实验数据进行分析 and 解释、并通过信息综合得到合理有效的结论
毕业要求 5: 使用现代工具 能够针对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题,开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具,包括对复杂计算机工程及其相关领域问题的预测与模拟,并能够理解其局限性	5-1. 了解常用开发环境及开发工具的性能、适应范围以及对开发、分析的适应性,并能正确应用
	5-2. 针对具体的对象,能够选择并使用恰当的开发工具进行设计、计算和分析,并能够理解其局限性
	5-3. 能够针对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题,选用满足特定需求的现代工具,模拟计算机及其相关领域的专业问题
毕业要求 6: 工程与社会 能够基于计算机软件、大数据处理、物联网工程等相关领域相关背景知识进行合理分析,评价计算机专业工程实践和计算机软件、大数据处理、物联网工程等相关领域复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响,并理解应承担的责任	6-1. 了解与计算机软件、大数据处理、物联网工程等相关领域的法律、法规和产业政策,并理解计算机工程实践对于社会、健康、安全、法律以及文化的可能影响
	6-2. 能够基于计算机科学与技术专业知识,结合相关的应用背景知识,评价计算机专业工程实践对于社会、安全、法律和文化的可能影响,并理解应承担的责任
	6-3. 能够评价计算机专业工程实践对于社会、安全、法律和文化的可能影响,并理解应承担的责任
毕业要求 7: 环境和可持续发展 能够理解和评价针对计算机软件、大数据处理、物联网工程等相关领域复杂工程问题的工程实践对环境、社会可持续发展的影响	7-1. 具有环境保护的自觉和可持续发展的意识;了解环境保护与可持续发展相关的方针与政策、法律与法规
	7-2. 能够理解实际解决方案和工程实践的可持续性,理解和评价计算机软件、大数据处理、物联网工程等相关领域复杂工程问题的解决方案和计算机专业工程实践对环境、社会可持续发展的影响
毕业要求 8: 职业规范 具有人文社会科学素养、社会责任感,能够在工程实践中理解并遵守工程职业道德和规范,履行责任	8-1. 具有基本的人文社会素养,能够运用历史、哲学的知识和方法认识、分析社会现象,树立和践行社会主义核心价值观,理解个人与社会的关系,了解中国国情,明确个人作为社会主义事业建设者和接班人所肩负的责任和使命。
	8-2. 能够拥有健康的体质,具有良好的心理素质和社会责任感
	8-3. 理解诚实守信的计算机软件、大数据处理、物联网工程等相关领域的工程职业道德和规范,并能自觉遵守,理解计算机软件、大数据处理、物联网工程等相关领域工程师对公众的社会责任
毕业要求 9: 个人和团队 能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色	9-1. 在多学科背景下明确团队的角色构成和职责分工,能够具有团队合作意识,能够提出自己的想法并且倾听其他成员的意见和建议
	9-2. 能够与团队其他成员有效沟通,能够在团队中承担个体、团队成员以及负责人的角色,并完成团队分配的任务
毕业要求 10: 沟通 能够就计算机软件、大数据处理、物联网工程等相关领域复杂工程问题与业界同行及社会公众进行有效沟通和交流,包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。并具备一定的国际视野,能够在跨文化背景下进行沟通和交流	10-1. 能够将计算机软件、大数据处理、物联网工程等相关领域复杂工程问题用文稿或图纸等技术文件进行清晰表达
	10-2. 能够通过文稿或图纸等技术文件利用现代信息技术与业界同行及社会公众就计算机软件、大数据处理、物联网工程等相关领域复杂工程问题进行沟通交流
	10-3. 了解计算机科学与技术专业相关行业的热点问题与国际状况
	10-4. 具备一门外国语的基本听、说、读、写、译能力,能够阅读专业领域的外文资料,能够在跨文化背景下进行沟通和交流
毕业要求 11: 项目管理 理解并掌握计算机软件、大数据处理、物联网工程等相关领域中工程管理原理与经济决策方法,能在多学科环境中应用	11-1. 能够理解和掌握计算机工程的管理原理和经济决策方法
	11-2. 能够在解决计算机工程方案设计过程中,运用工程管理和经济决策的方法
毕业要求 12:	12-1. 具有自主学习和终身学习意识

终身学习 具有自主学习和终身学习的意识，有不断学习和适应发展的能力	12-2. 具有自主学习的能力，包括对技术问题的理解能力、归纳总结的能力和解决问题的能力
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专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。

## 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标				
	培养目标 1	培养目标 2	培养目标 3	培养目标 4	培养目标 5
1: 工程知识		√			
2: 问题分析		√			
3: 设计/开发解决方案	√	√	√		
4: 研究		√	√		
5: 使用现代工具		√		√	
6: 工程与社会	√				
7: 环境和可持续发展	√				
8: 职业规范	√				
9: 个人和团队					√
10: 沟通				√	
11: 项目管理					√
12: 终身学习			√		

### 四、主干学科

计算机科学与技术

### 五、专业核心课程

电路与电子技术基础、算法与数据结构、操作系统、计算机网络、面向对象程序设计、数据库系统原理、软件工程

### 六、修业年限

本科基本学制 2 年，弹性学习年限 2-4 年，按照学分管理制度管理。

### 七、授予学位

学生应至少修满 89.5 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者，可授予工学学士学位。

## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例 (%)
通识教育课	通识教育必修课	思政类	必修	10	21	23.46
		外语类		6		
		军事安全类		2		
		劳动教育类		1		
		创新创业类		1		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	1	5	5.59
		中国与世界(500)		1		
		四史(600)		1		
		经济管理类(700)		1		
		传统文化(900)		1		
通识教育实践课	军训	实践	2	2	2.23	
学科平台课	学科基础课程	公共基础类	必修	28.5	28.5	68.72
		专业基础类				
	学科实践课程	-	实践			
专业教育课	专业核心课程	-	必修	6.5	29	
	专业选修课程	-	选修	2.5		
	专业实践课程	-	实践	20		
能力拓展课	专业特色课程	-	必修 (或实践)	4	4	
课外环节	课外通识实践	人文社会实践	课外实践	4		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
	生涯教育	成长规划类		1		
总学分/比例					89.5	100%



# Computer Science and Technology Major 2021 Undergraduate Education Program

## I. Educational Objectives

This major cultivates high quality application-oriented talents with noble moral quality, good professional quality and social responsibility, which can meet the needs of Liaoning's economic construction and the development of China's IT industry, and can make use of solid professional basic knowledge to engage in technology research, product development, application development, system implementation and maintenance in related fields such as computer software, big data processing, Internet of things engineering and be competent for the technical or management backbone of enterprises and institutions.

Graduates of this major should obtain the following knowledge and competences:

1. Be able to reflect a high sense of social responsibility and engineering ethics, and have the willingness and ability to serve the society, considering social, legal, safety, environmental and sustainability factors in social activities.

2. Be able to use relevant knowledge and technology in the actual environment of enterprises and society according to the technical specifications of computer engineering, and have the ability of technical research, product development, application development and system implementation and maintenance.

3. Be able to obtain a certain research and development spirit, innovation consciousness and the ability to actively seek and acquire new knowledge and new technology in the field of new computer products, new technology, etc. according to the needs of the IT technology development and social development.

4. Be able to skillfully use foreign language and computer-related tools in the social environment, and effectively communicate with peers at home and abroad on software and hardware system development, product development, new knowledge and new technology, etc.

5. Be able to effectively play an important role in a team composed of multi-role personnel, and then manage multi-disciplinary projects from a systematic perspective.

## II. Major direction

Computer science and technology

## III. Graduation Requirements

There are 12 graduation requirements for students majoring in computer science and technology, and each graduation requirement index point is decomposed as follows:

1. Engineering Knowledge: Be able to master the knowledge of mathematics, natural science and computer required by the major, and be able to solve complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields.

2. Problem Analysis: Be able to apply the basic principles of mathematics, natural science and engineering

science to identify, express and analyze complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields through literature research, so as to obtain effective conclusions.

3. Design / Development Solutions: Be able to provide solutions to complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields, design systems, units (components) or technological processes to meet specific needs, and reflect the sense of innovation in the design process, considering social, health, safety, legal, cultural and environmental factors.

4. Research: Be able to research complex engineering problems in computer software, big data processing, Internet of things and other related fields based on scientific principles and methods, including designing experiments, analyzing and interpreting data, and getting reasonable and effective conclusions through information synthesis.

5. Using modern tools: Be able to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields, including the prediction and simulation of complex computer engineering and related fields, and understand their limitations.

6. Engineering and Society: Be able to conduct reasonable analysis based on the relevant background knowledge in related fields such as computer software, big data processing, and Internet of things engineering, evaluate the impact of computer professional engineering practice and complex engineering problem solutions in computer software, big data processing, Internet of things engineering and other related fields on society, health, safety, law and culture, and understand the responsibilities that should be taken.

7. Environment and Sustainable Development: Be able to understand and evaluate the impact of engineering practice on the environment and social sustainable development for complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields.

8. Professional Norms: Be able to understand and abide by engineering professional ethics and norms in engineering practice, and fulfill responsibilities, with humanities and social science literacy and sense of social responsibility

9. Individual and Teams: Be able to take on the role of individual, team member and leader in a team of multidisciplinary context.

10. Communication: Be able to effectively communicate with peers in the industry and the public on complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields, including writing reports, designing manuscripts, making statements, and clearly expressing or responding to instructions, to have a certain international vision, being able to communicate and exchange ideas in the cross-cultural background.

11. Project Management: Be able to understand and master the engineering management principles and economic decision-making methods in computer software, big data processing, Internet of things engineering and other related fields, and to apply them in a multidisciplinary environment.

12. Lifelong Learning: Be able to have the consciousness of autonomous learning and lifelong learning, and have the ability of continuous learning and adapting to the social development.

Graduation Requirements	Indices
<p>Requirement 1: Engineering Knowledge Be able to master the knowledge of mathematics, natural science and computer required by the major, and be able to solve complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields.</p>	1-1. Be able to master the basic knowledge of mathematics, natural science and computer science, and use it to express the mathematical model of practical problems
	1-2. Be able to master the knowledge and principles of mathematics, natural science and computer science, and use it to establish mathematical models for practical problems
	1-3. Be able to use the professional knowledge and principles of computer science to carry out the unit analysis and design of computer software and hardware system based on the established mathematical model.
	1-4. Be able to use the professional knowledge and principles of computer science to build solutions to practical problems
<p>Requirement 2: Problem Analysis Be able to apply the basic principles of mathematics, natural science and engineering science to identify, express and analyze complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields through literature research, so as to obtain effective conclusions.</p>	2-1. Be able to use mathematics, physics and professional knowledge to identify and judge complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields
	2-2. Be able to express complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields based on mathematics, physics and professional knowledge
	2-3. Be able to realize that there are multiple solutions to the problem and seek alternative solutions
	2-4. Be able to analyze and screen the solutions of complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields through literature research.
<p>Requirement 3: Design Solutions Be able to design solutions to complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields, and design systems, units (components) or technological processes to meet specific needs. The design process should reflect the sense of innovation, considering social, health, safety, legal, cultural and environmental factors.</p>	3-1. Be able to master the basic design / development methods and technologies of the whole cycle and process of engineering design and product development in computer software, big data processing, Internet of things engineering and other related fields
	3-2. Be able to complete the design of computer software and hardware system units, and reflect the sense of innovation in the design based on the specific needs of computer software, big data processing, Internet of things engineering and other related fields.
	3-3. Be able to consider safety, law, culture and environment in the design
<p>Requirement 4: Research Be able to research complex engineering problems in computer software, big data processing, Internet of things and other related fields based on scientific principles and methods, including designing experiments, analyzing and interpreting data, and getting</p>	4-1. Be able to use the literature to establish the corresponding research models for the complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields, based on the principle of computer science, and meet the basic requirements of system development and engineering
	4-2. Be able to put forward its own research methods and ideas, and design a practical simulation or experimental scheme based on the research model
	4-3. Be able to perform the experiment according to the experimental scheme,

reasonable and effective conclusions through information synthesis.	analyze and explain the experimental data, and reach reasonable and effective conclusions through information synthesis
<p>Requirement 5: Using modern tools</p> <p>Be able to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields, including the prediction and simulation of complex computer engineering and related fields, and understand their limitations.</p>	5-1. Be able to understand the performance adaptation scope and adaptability to development and analysis of common development environment and development tools, and apply them correctly
	5-2. Be able to select and use appropriate development tools to design, calculate and analyze specific objects, , and understand their limitations
	5-3. Be able to select modern tools to meet specific needs and simulate professional problems in computer and related fields for complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields
<p>Requirement 6: Engineering and Society</p> <p>Be able to conduct reasonable analysis based on the relevant background knowledge in the related fields such as computer software, big data processing, and Internet of things engineering and evaluate the impact of computer professional engineering practice and solutions to complex engineering problem in the fields of computer software, big data processing, Internet of things engineering and other related fields on society, health, safety, law and culture, and understand the responsibilities that should be taken.</p>	6-1. Understand laws, regulations and industrial policies related to computer software, big data processing, Internet of things engineering and other fields, and understand the possible impact of computer engineering practice on society, health, safety, law and culture
	6-2. Be able to evaluate the possible impact of computer engineering practice on society, security, law and culture based on the professional knowledge of computer science and technology and relevant application background knowledge, and understand the responsibilities to be undertaken
	6-3. Be able to evaluate the possible impact of computer engineering practice on society, security, law and culture, and understand the responsibilities that should be taken
<p>Requirement 7: Environment and Sustainable Development</p> <p>Be able to understand and evaluate the impact of engineering practice on the environment and social sustainable development for complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields.</p>	7-1. Be able to have the consciousness of environmental protection and sustainable development; Understand the guidelines, policies, laws and regulations related to environmental protection and sustainable development
	7-2. Be able to understand the sustainability of practical solutions and engineering practice, understand and evaluate the solutions of complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields, and the impact of computer professional engineering practice on the sustainable development of environment and society
<p>Requirement 8: Professional Norms</p> <p>Be able to understand and abide by engineering professional ethics and norms in engineering practice, and fulfill responsibilities, with humanities and social science literacy, sense of social responsibilities.</p>	8-1. Be able to have basic humanistic and social literacy, understand and analyze social phenomena by using historical and philosophical knowledge and methods, establish and practice socialist core values, understand the relationship between individuals and society, understand China's national conditions, and clarify the responsibilities and missions of individuals as builders and successors of the socialist cause.
	8-2. Be able to have a healthy physique, good psychological quality and the sense of social responsibility
	8-3. Be able to understand the engineering professional ethics and norms in the fields of honest and fair, honest and trustworthy computer software, big data

	processing, Internet of things engineering, and consciously abide by and understand the social responsibility of engineers in computer software, big data processing, Internet of things engineering and other related fields to the public Individuals and teams
Requirement 9: Individuals and Teams Be able to take on the role of individual, team member and leader in a team of multidisciplinary context.	9-1. Be able to clarify the role composition and responsibility division of the team in the multi-disciplinary context, have a sense of teamwork, put forward their own ideas and listen to the opinions and suggestions of other members 9-2. Be able to communicate with other team members effectively, take on the role of individual, team member and leader in the team, and complete the tasks assigned by the team
Requirement 10: Communication Be able to effectively communicate with peers in the industry and the public on complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields, including writing reports, designing manuscripts, making statements, and clearly expressing or responding to instructions, to have a certain international vision, being able to communicate and exchange in the cross-cultural background.	10-1. Be able to clearly express complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields with technical documents such as manuscripts or drawings 10-2. Be able to use modern information technology to communicate with peers in the industry and the public on complex engineering problems in computer software, big data processing, Internet of things engineering and other related fields through technical documents such as manuscripts or drawings 10-3. Be able to understand the hot issues and international situation of computer science and technology and its relevant industries 10-4. Have basic listening, speaking, reading, writing and translation skills in a foreign language, be able to read foreign language materials in professional fields, and be able to communicate and communicate in a cross-cultural context
Requirement 11: Project Management Be able to understand and master the engineering management principles and economic decision-making methods in computer software, big data processing, Internet of things engineering and other related fields, and to apply them in a multidisciplinary environment.	11-1. Be able to understand and master the management principles and economic decision-making methods of computer engineering 11-2. Be able to use the methods of engineering management and economic decision-making in the process of solving computer engineering scheme design
Requirement 12: Lifelong Learning Be able to have the consciousness of autonomous learning and lifelong learning, and have the ability of continuous learning and adapting to the social development.	12-1. Be able to have the consciousness of autonomous learning and lifelong learning 12-2. Be able to have the ability of autonomous learning, including the ability to understand technical problems, the ability to summarize and solve problems

## The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives				
	Educational Objectives 1	Educational Objectives 2	Educational Objectives 3	Educational Objectives 4	Educational Objectives 5
1: Engineering Knowledge		R			
2: Problem Analysis		R			
3: Design/Development Solutions	R	R	R		
4: Research		R	R		
5: Using Modern Tools		R		R	
6: Engineering and the Society	R				
7: Environment and Sustainable Development	R				
8: Career Planning	R				
9: Individuals and Teams					R
10: Communication				R	
11: Project Management					R
12: Lifelong Learning			R		

### IV. Major Subject

Computer Science and Technology

### V. Core Courses

Fundamentals of circuit and electronic technology , algorithm and data structure, operating system, computer network, object-oriented programming, principle of database system , software engineering.

### VI. Educational System

According to the credit system, the basic length of undergraduate education is 2 years, and the flexible study period is 2-4 years.

### VII. Confer Degrees

Students should complete at least 89.5 credits before graduation. The Bachelor of engineering degree can be granted to those who meet the degree awarding requirements of the relevant regulations on the awarding of bachelor's degree for undergraduates of Shenyang University of Chemical Technology (revised in March 2017).

### VIII.Credit Requirements

Course Type	Course Modules		Course Nature	Credit Requirement	Subtotal	Proportion (%)
General Education	General Education (Compulsory)	Ideological and Political Courses	Compulsory	10	21	23.46
		Foreign Language Courses		6		
		Military and Safety Courses		2		
		Labor and Sport Education		1		
		Innovation and Entrepreneurship		1		
		Mental Health		1		
	General Education (Optional)	Aesthetic Education(400)	Optional	1	5	5.59
		China and the World(500)		1		
		Four Histories(600)		1		
		Economic Management(700)		1		
		Traditional Culture(900)		1		
General Education (Practice)	Military Training	Practice	2	2	2.23	
Discipline Education	Basic Courses	Public Basic Class	Compulsory	28.5	28.5	68.72
		Professional Foundation				
	Basic Practice Sessions	-	Practice			
Specialized Education	Core Courses	-	Compulsory	6.5	29	
	Optional Courses	-	Optional	2.5		
	Specialized Practice Sessions	-	Practice	20		
Competency Development	Individualized Courses	-	Compulsory (or Practice)	4	4	
Extracurricular links	Extracurricular General Education Practice	Culture and Society Practice	Extracurricular Practice	4	89.5	100%
		Mentally and Physically Practice				
		Foreign Language Proficiency Training Practice				
	Extracurricular Characteristic Practice	Innovative Training		4		
		Innovation Competition				
		ChuangkeActivities				
	Career Education	Growth Planning Courses		1		
Total/Proportion					89.5	100%

## 九、计算机科学与技术专业教学进程表

### Table of Teaching Schedule for Computer Science Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th			
通识教育课 General Education	必修 Compulsory	思政类 Ideological and Political Courses	0710053003	中国近现代史纲要   Outline of Chinese Contemporary and Modern History	3.0	48	32			16	2						
			0710103003	马克思主义基本原理*   Basic Principles of Marxism*	3.0	48	32			16		2					
			0710112001	习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8		3					
			0710011303	形势与政策   Current Situation and Policies	1.0	32	32				1	1	1	1			
		外语类 Foreign Language Courses	0211003103	大学外语I   College EnglishI	3.0	48					3						
			0211003203	大学外语II   College English II	3.0	48						3					
		军事安全类 Military and Safety Courses	0710081003	军事理论   Military Theory	1.0	16					2						
			1618041004	安全教育   Safety Education	1.0	16						2					
		劳动教育类 Labor Education	2640021003	劳动教育   Labour Education	1.0	16	16					2					



课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th		
通识教育课 General Education	必修 Compulsory	创新创业类 Innovation and Entrepreneurship courses	1651001404	创造性思维与创新方法   Creative Thinking and Innovative Methods	1.0	16					2					
		心理健康类 Mental Health Courses	0510041003	大学生心理与健康教育   Mental and Health Education for College Students	1.0	16	16				2					
		小计 Subtotal				21	320	43	0	0	40					
	选修 Optional		分为经济管理类（1.0）、美育类（1.0）、四史（1.0）、传统文化（1.0）、中国与世界课程类（1.0）5个模块 每个模块最多选修 2.0 学分，每学期最多选修 2 门课程。 Including 6 modules: Economic Management, Aesthetic Education, Science and Technology, Four Histories, Traditional Chinese Culture, China and the World. Up to 2.0 credits per module and up to 2 courses per semester.													
	小计 Subtotal			5												
	实践 Practice	0415102013	军训   Military Training	2.0	48					48	2					必选
	合计 Total				28											
学科平台课 Discipline Education	必修 Compulsory	数学与自然科学类 Natural Science & Mathematics	0310002103	高等数学 I*   Advanced Mathematics I*	2.0	32					2					
			0310002203	高等数学 II*   Advanced Mathematics II*	2.0	32						2				
		小计 Subtotal			4	64	0	0	0	0	2	2	0	0		
	工程基础类 Foundation Engineering	1612021004	工程导论   Introduction to Engineering	1	16	16					2					
		1612051004	文献检索与科技论文写作   Literature Retrieval and Writing of Scientific Papers	1	18	12	6						2			

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th			
学科平台课 Discipline Education	必修 Compulsory	专业基础类 Subject Foundation Requisite	小计 Subtotal		2	34	28	6	0	0	2	0	2	0			
			1610082004	算法与数据结构*   Algorithm and Data Structure*	2.5	44	32	12			2						
			1610132004	操作系统*   Operating System*	2	32	32					2					
			1610142004	计算机网络*   Computer Network*	2.5	44	32	12			2						
			1617553004	电路与电子技术基础   Fundamentals of circuit and electronic technology	2.5	44	32	12			2						
			1610092004	计算机组成原理*   Principles of Computer Organization*	2.5	44.0	32	12					2				
			1618073004	面向对象程序设计   Object-Oriented Programming	3	56	32		24		2						
			1618122004	数据库系统原理   Principle of Database System	2.5	44	32		12		2						
			1610152004	软件工程   Software Engineering	2	32	32						2				
			小计 Subtotal		19.5	340	268	48	36	0	13	6	0	0			
	实践 Practice			1617311024	程序设计基础课程设计   Course Design of Operating System	1	24		24			1					
				1617302024	数据结构课程设计   Course Design of Data Structure	2	48		48				4				
				小计 Subtotal		3	72	0	72	0	0	1	4	0	0		

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	
		合计 Total		28.5	510	284	126	36	0	16	10	2	0	
专业教育课 Specialized Education	必修 Compulsory	1610893004	网络工程技术竞赛   Network Engineering Technology Competition	2	44	8	36				2			
		1617501004	Linux 操作系统*   Linux Operation System	1.5	24	24					2			
		1610735004	算法设计与分析    Algorithm Design and Analysis	3	52	40	12				3			
		小计 Subtotal		6.5	108	72	48	0	0	0	7	0	0	
	选修 Optional	1632832004	数学竞赛   Mathematics Competition	2	32	32						2		
		1632842004	专业技术竞赛   Professional Technology Competition	2	32	32						2		
		1634172004	人工智能与大数据分析   Artificial Intelligence and Big Data Analysis	2	36	24	12					2		
		1637512004	移动应用开发   Mobile Internet Technology	2	36	24	12					2		
		1614133004	网络编程技术   Advanced Network Programming Technology	3	56	32	24				2			
		1638002004	Python 语言   Python Language	2	40	16	24				2			
		1650752104	程序设计竞赛 I   Programming Competition I	2.5	48	24	24				2			

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes	
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th		
专业教育课 Specialized Education	选修 Optional	1637403004	无线网络技术   Wireless Network Computing	3	56	32	24				2				
		1637963004	人工智能系统设计   Artificial intelligence system design	3	56	32	24				2				
		小计 Subtotal		2.5	336	216	120	0	0	4	4	8	0		
	(选修课至少修读 2.5 学分 At least 2.5 credits for elective courses)														
	实践 Practice	1612061024	面向对象程序设计实践   Practices for Object-Oriented Programming	1.5	36						3				
		1617500024	Linux 操作系统课程设计   Course Design of Linux Operation System	0.5	12						2				
		1615232034	生产实习   Production Practice	2									2		
		1617391024	人工智能综合实践   Comprehensive Practice of Artificial Intelligence	1	24								2		
		1617411024	数据库系统实践   Practices for Database System	1	24						2				
		1617031044	毕业设计(论文)   Graduation Design (Thesis)	14											14
		小计 Subtotal		20	96	0	0	0	0	0	7	4	14		
	合计 Total				29										
	能力拓展课 Competency Development	必修或实践 Compulsory or Practice	1615254024	专业综合实践   Professional comprehensive practice	4	96		96					12		
小计 Subtotal			4	96	0	96	0	0	0	0	6	0			
(能力拓展课至少修读 4 学分 At least 4 credits for capacity development course)															

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes			
						讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th				
总计 Sum						89.5	1178	494	258	0	80	30.5	31.5	12	15		
课外环节 Extracurricular Sessions	课外实践 Extracurricular Practice	人文社会实践 Culture and Society Practice	1614010014	社会调查   Social Survey	0.5	12				12						分散	
		身心健康社会实践 Mentally and Physically Practice	0415102013	课外体育锻炼   Extracurricular Physical Exercise	0.5	12				12							分散
			2640030013	劳动教育实践   Labour Education Practice	0.5	12				12	0.5						分散
			0510070313	心理健康辅导   Mental Health Counseling	0.5	12				12							分散
		外语技能实践类 Foreign Language Proficiency Training Practice	0210010013	外语技能实践（初级）   Foreign Language Proficiency Training Practice（elementary）	2.0	48				48						2	（2选1） 分散
			0210020013	外语技能实践（高级）   Foreign Language Proficiency Training Practice（advanced）	2.0	48				48						2	
		能力与创新实践 Capability and Innovation Practice	1615494014	大学生素质拓展与创新实践   Quality Development and Innovation Practice	4.0	96				96	1~48 学期依据《沈阳化工 大学创新创业实践学分认 定办法》由创新创业学院认 定				分散		
		成长规划类 Growth Planning Courses	1617601304	职业规划与就业指导   Career Planning and Employment Guidance	1.0	40	40				1						分散
小计 Subtotal																	

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5，课程名称中画\*为考试课。

Note: “Cre. (Credits)”, “T.C.H. (Total Credit Hours)”, “Lec. (Lecture)”, “Exp. (Experiment)”, “Pro. (Programming)”, “Pra. (Practice)”.

## 十、计算机科学与技术专业学士学位课程一览表

**A list of bachelor's degree programs in Computer Science and Technology**

课程类别 Course Type	模块名称 Modules	序号 No.	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester
通识教育课 General Education	思政类 Ideological and Political courses	1	0710103003	马克思主义基本原理*   Basic Principles of Marxism*	3	2
学科平台课 Discipline Education	数学 Mathematics	2	0310002103	高等数学 I*   Advanced Mathematics I*	2	1
		3	0310002203	高等数学 II*   Advanced Mathematics II*	2	2
	专业基础 Subject Foundation Requisite	4	1610082004	算法与数据结构*   Algorithm and Data Structure*	2.5	1
		5	1610132004	操作系统*   Operating System*	2	2
		6	1610142004	计算机网络*   Computer Network*	2.5	1
		7	1617553004	电路与电子技术基础   Fundamentals of Circuit and Electronic Technology	2.5	1
		8	1618073004	面向对象程序设计   Object-Oriented Programming	3	1
		9	1618122004	数据库系统原理   Principle of Database System	2.5	1
		10	1610152004	软件工程   Software Engineering	2	2
		11	1610893004	网络工程技术竞赛   Network Engineering Technology Competition	2	2
专业教育课 Specialized Education	专业必修课 Compulsory	12	1617501004	Linux 操作系统*   Linux Operation System	1.5	2
		13	1610735004	算法设计与分析   Algorithm Design and Analysis	3	2

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》

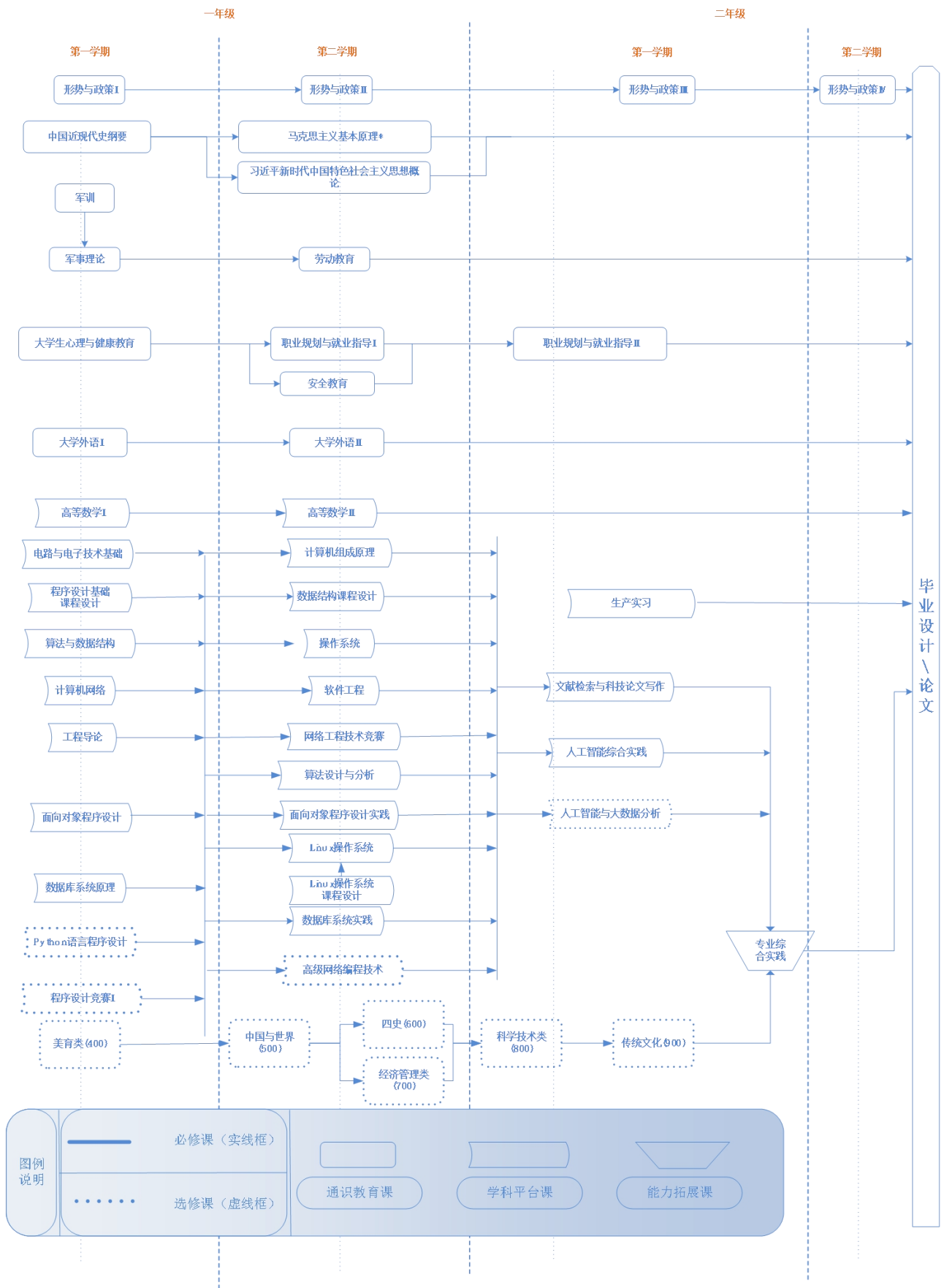
### 十一、全学程实践环节周历安排 Weekly Calendar of all Practice Sessions

学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注
一		☆	☆															::	::	·		
二																		::	::	·		
三							/	/										::	::	·		
四	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	

符号说明(Symbol Description):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P 各类实训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼ 认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计(论文)||Graduation Project(Thesis)    ·小学期||Primary Term

## 十二、课程体系配置图 Curriculum System Configuration Diagram





十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements (High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																			
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	12.2	
习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																							L	H												
马克思主义基本原理概论   Basic Principles of Marxism																							L	H												
形势与政策   Current Situation and Policies											H								H		M		H													
大学外语I-II   College English I-II																																		H		
军事理论   Military Theory																								M												
安全教育   Safety Education																				H	H															
劳动教育   Labour Education																									H											
创造性思维与创新方法   Creative Thinking and Innovative Methods											H																	L			M					



课程 (Courses)	毕业能力要求 (Graduation Requirements)																																						
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	12.2				
程序设计基础课程设计   Course Design of Operating System										H			H			H																							
算法与数据结构   Algorithm and Data Structure		H	M			H						H																											
面向对象程序设计   Object-Oriented Programming			H	M			H																																
网络工程技术竞赛   Network Engineering Technology Competition				H	M							H																											
数据库系统原理			H									H															M		M										
Linux 操作系统   Linux Operation System				H								M																											
计算机网络   Computer Network				H								H							M																				
操作系统   Operating System				H	H			L				H																											
软件工程   Software Engineering							L		H		H								M			H													H				
数据结构课程设计   Course Design of Data Structure		H											H																										
人工智能综合实践 Comprehensive Practice of Artificial Intelligence											H		H															H											
数据库系统实践    Practices for Database System															H								M																
毕业设计 (论文)   Graduation Design (Thesis)							M	H			M		M	H		H					H														H	H		H	H

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																					
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	12.2			
专业综合实践   Comprehensive Professional practices								H			M		M	H														H		H								H

# 沈阳化工大学专升本培养方案

## 计算机科学与技术学院

专业名称：软件工程

专业代码：080902

制 定：郑秀红

审 核：张 波

审 定：于三三

批 准：金志浩

2021 年 8 月

# 软件工程专业（专升本）培养方案

## 一、培养目标

本专业培养软件工程领域高素质的应用型软件工程师，他们具有良好的综合素质及创新意识，具有扎实的数学和自然科学基础知识，掌握计算机科学领域基础理论知识。能够利用深入的软件设计理论、先进的软件开发技术和现代软件工程规范进行应用型复杂软件系统的设计、开发、测试、项目管理等工作；在工作中，能通过不断学习进行自我提高，以适应软件行业的不断发展；在软件项目开发中，能利用外语、软件表达工具等进行交流与沟通，能与团队成员合作，表现出道德品质、职业素养和责任感；在项目管理与开发中能考虑软件系统对社会的影响。

本专业毕业生具有如下目标预测：

(1)具有较高的人文素质修养和科学研究素养，具有工程素养和创新意识。

(2)掌握数学、自然科学、计算机科学、和计算机软件领域的基础理论知识，并能在复杂工程问题的解决过程中合理运用。

(3)具备复杂软件系统方案的设计与实现能力，并能在一个团队中有效地发挥重要作用，或者担任一个团队的领导责任。

(4)具备自学和获取知识的能力；具备较强的知识更新能力。

(5)能在计算机领域、软件工程领域从事计算机教学、软件产品研发及软件产品测试的工作。

## 二、专业方向

软件工程

## 三、毕业要求

本专业要求学生掌握计算机和软件工程等方面的基础理论和基本知识，主要学习与研究软件开发和测试的基本原理与实现大型软件开发的工程技术，具有对新的软件设计、对算法的优化，改造的基本能力，能从事本学科及相邻交叉学科的创新工作。

毕业能力要求及其指标点分解：

毕业能力要求	指标点
毕业要求 1： 工程知识：掌握本专业所需的数学、自然科学知识和计算机学科知识，并能用于解决计算机软件、软件工程等相关领域的复杂工程问题。	1-1 掌握数学、自然科学和计算机学科的基础知识，用于表述实际问题的数学模型；
	1-2 掌握数学、自然科学和计算机学科的原理和知识，用于建立实际问题的数学模型；
	1-3 运用计算机学科的专业知识和原理，依据建立的数学模型，进行计算机软件模块分析与设计；
	1-4 将计算机学科的专业知识和原理用于建立实际问题的解决方案；
毕业要求 2： 问题分析：能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究分析计算机软件、软件工程等相	2-1 能够运用数学、自然科学和专业原理，识别和判断计算机软件、软件工程等相关领域复杂工程问题；
	2-2 能够基于数学、自然科学和专业原理，表达计算机软件、软件工程等相关领域复杂工程问题；
	2-3 能够认识到解决问题有多种方案，寻求可替代的解决方案；

关领域复杂工程问题，以获得有效结论。	2-4 通过文献研究，分析和筛选出计算机软件、软件工程等相关领域复杂工程问题的解决方案；
毕业要求 3： 设计/开发解决方案：能够设计针对计算机软件、软件工程等相关领域复杂工程问题的解决方案，设计满足特定需求的软件系统、构件或项目开发流程，并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素。	3-1 掌握计算机软件、软件工程等相关领域内工程设计和系统开发全周期、全流程的基本设计/开发方法和技术；
	3-2 能够针对计算机软件、软件工程等相关领域内的特定需求，完成计算机软件系统构件的设计，并能在设计中体现创新意识；
	3-3 在设计中能够考虑安全、法律、文化以及环境等制约因素；
毕业要求 4： 研究：能够基于科学原理并采用科学方法对计算机软件、软件工程等相关领域复杂工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。	4-1 基于计算机科学原理，能够利用文献资料，针对计算机软件、软件工程等相关领域复杂工程问题建立相应研究模型，并符合系统开发和工程化的基本要求；
	4-2 针对研究模型，提出自己的研究思路和想法，设计出切实可行的模拟或实验方案；
	4-3 能够依据实验方案开展实验，对实验数据进行分析 and 解释、并通过信息综合得到合理有效的结论。
毕业要求 5： 使用现代工具：能够针对计算机软件、软件工程等相关领域复杂工程问题，开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具，包括对复杂软件工程及其相关领域问题的预测与模拟，并能够理解其局限性。	5-1 了解常用开发环境及开发工具的性能、适应范围以及对开发、分析的适应性，并能正确应用；
	5-2 针对具体的对象，能够选择并使用恰当的开发工具进行设计、计算和分析，并能够理解其局限性；
	5-3 能够针对计算机软件、软件工程等相关领域复杂工程问题，选用满足特定需求的现代工具，模拟计算机及其相关领域的专业问题。
毕业要求 6： 工程与社会：能够基于计算机软件、软件工程等相关领域相关背景知识进行合理分析，评价软件工程专业工程实践和计算机软件、软件工程等相关领域复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。	6-1 能够了解软件工程专业领域工程实训需要具备的相关能力；
	6-2 了解计算机软件、软件工程等相关领域相关背景知识和技术标准体系；了解与计算机软件、软件工程等相关领域相关的法律、法规和产业政策；
	6-3 能够评价软件工程专业工程实践对于社会、安全、法律和文化的可能影响，并理解应承担的责任。
毕业要求 7： 环境和可持续发展：能够理解和评价针对计算机软件、软件工程等相关领域复杂工程问题的工程实践对环境、社会可持续发展的影响。	7-1 具有环境保护的自觉和可持续发展的意识；了解环境保护与可持续发展相关的方针与政策、法律与法规；
	7-2 能够理解实际解决方案和工程实践的可持续性，理解和评价计算机软件、软件工程等相关领域复杂工程问题的解决方案和软件工程专业工程实践对环境、社会可持续发展的影响。
毕业要求 8： 职业规范：具有人文社会科学素养、社会责任感，能够在工程实践中理解并遵守工程职业道德和规范，履行责任。	8-1 具有基本的人文社会素养，能够运用历史、哲学的知识和方法认识、分析社会现象，理解个人与社会的关系，了解中国国情；
	8-2 能够拥有健康的体质，具有正确的价值观，具有良好的心理素质和社会责任感；
	8-3 理解诚实公正、诚实守信的计算机软件、软件工程等相关领域的工程职业道德和规范，并能自觉遵守，理解计算机软件、软件工程等相关领域工程师对公众的社会责任。
毕业要求 9： 个人和团队：能够在多学科背景下的团队	9-1 在多学科背景下明确团队的角色构成和职责分工，能够具有团队合作意识，能够提出自己的想法并且倾听其他成员的意见和建议；

中承担个体、团队成员以及负责人的角色。	9-2 能够与团队其他成员有效沟通，能够在团队中承担个体、团队成员以及负责人的角色，并完成团队分配的任务。
<b>毕业要求 10:</b> 沟通：能够就计算机软件、软件工程等相关领域复杂工程问题与业界同行及社会公众进行有效沟通和交流，包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。并具备一定的国际视野，能够在跨文化背景下进行沟通和交流。	10-1 能够将计算机软件、软件工程等相关领域复杂工程问题用文稿或图纸等技术文件进行清晰表达；
	10-2 能够通过文稿或图纸等技术文件利用现代信息技术与业界同行及社会公众就计算机软件、软件工程等相关领域复杂工程问题进行沟通交流；
	10-3 了解软件工程专业相关行业的热点问题与国际状况；
	10-4 具备一门外语的听说读写译能力，能够阅读专业领域的外文资料，能够在跨文化背景下与同行进行交流。
<b>毕业要求 11:</b> 项目管理：理解并掌握计算机软件、软件工程相关领域中工程管理原理与经济决策方法，并能在多学科环境中应用。	11-1 能够理解和掌握软件工程管理原理和经济决策方法；
	11-2 能够在解决软件工程方案设计过程中，运用工程管理和经济决策的方法。
<b>毕业要求 12:</b> 终身学习：具有自主学习和终身学习的意识，有不断学习和适应发展的能力。	12-1 具有自主学习和终身学习意识；
	12-2 具有自主学习的能力，包括对技术问题的理解能力、归纳总结的能力和解决问题的能力。

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。

### 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标				
	培养目标 1	培养目标 2	培养目标 3	培养目标 4	培养目标 5
1: 工程知识		√			
2: 问题分析		√			
3: 设计/开发解决方案	√	√	√		√
4: 研究		√	√		
5: 使用现代工具		√	√		
6: 工程与社会	√		√		
7: 环境和可持续发展	√				
8: 职业规范	√			√	√
9: 个人和团队			√		√
10: 沟通			√	√	√
11: 项目管理					√
12: 终身学习				√	

## 四、主干学科

软件工程



## 五、专业核心课程

C 语言程序设计I、面向对象程序设计、离散数学、算法与数据结构、操作系统、数据库原理、编译原理、计算机网络、计算机组成原理、软件工程、软件质量保障和项目管理、UML 与系统分析设计。

## 六、修业年限

本科基本学制 2 年，弹性学习年限 2-4 年，按照学分管理制度管理。

## 七、授予学位

学生应至少修满 86.5 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者，可授予工学学士学位。

## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例 (%)
通识教育课	通识教育必修课	思政类	必修	10	21	24.28
		外语类		6		
		军事安全类		2		
		劳动教育类		1		
		创新创业类		1		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	1	5	5.78
		中国与世界(500)		1		
		四史(600)		1		
		经济管理类(700)		1		
		传统文化(900)		1		
通识教育实践课	军训	实践	2	2	2.31	
学科平台课	学科基础课程	公共基础类	必修	24	24	27.75
		专业基础类				
	学科实践课程	-	实践			
专业教育课	专业核心课程	-	必修	8.5	30.5	35.26
	专业选修课程	-	选修	2		
	专业实践课程	-	实践	20		
能力拓展课	专业特色课程	-	必修 (或实践)	4	4	4.62
课外环节	课外通识实践	人文社会实践	课外实践	4		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
	生涯教育	成长规划类		1		
总学分/比例					86.5	100%

# Software Engineer Major 2021 Undergraduate Education Program

## I. Educational Objectives

This major cultivates application-oriented software engineers in the field of software engineering, who have good comprehensive quality and innovative consciousness, solid basic knowledge of mathematics and natural science, and master basic theoretical knowledge in the field of computer science. They can design, develop, test and manage application-oriented complex software system by using in-depth software design theory, advanced software development technology and modern software engineering specifications; In the work, they can improve themselves through continuous learning to adapt to the continuous development of the software industry; In software project development, they can use foreign languages, software expression tools for communication and cooperate with team members, showing moral character, professionalism and sense of responsibility; In project management and development, They can consider the impact of software system on society.

Graduates should obtain knowledge and competences as follows:

(1) Have high humanistic quality and scientific research quality, engineering quality and innovation consciousness.

(2) Master the basic theoretical knowledge in the fields of mathematics, natural science, computer science, and software engineering, and be able to use it reasonably in the process of solving complex engineering problems.

(3) Have the ability to design and implement complex software system solutions, and can effectively play an important role in a team, or take the leadership responsibility of a team.

(4) Have the ability of self-study and knowledge acquisition; have strong ability to update knowledge

(5) Have the ability to engage in computer teaching, software development and software product testing in the field of computer and software engineering.

## II. Major direction

Software Engineering

## III. Graduation Requirements

This major requires students to master the basic theory and knowledge of computer and software engineering. Students study and research the basic principles of software development and testing and the engineering technology of large-scale software development, have the basic ability of new software design, algorithm optimization and transformation, and be able to engage in the innovation work of this discipline and adjacent interdisciplinary.

Graduates should obtain knowledge and competences as follows:

Graduation Requirements	Indices
<p>Requirement 1: Engineering knowledge: master the knowledge of mathematics, natural science and computer science; be able to solve complex engineering problems in computer software, software engineering and other related fields.</p>	1-2. Master the basic knowledge of mathematics, natural science and computer science, and use it to express the mathematical model of practical problems;
	1-2. Master the knowledge and principles of mathematics, natural science and computer science, and use them to establish mathematical models of practical problems;
	1-3. Use the professional knowledge and principles of computer science, according to the established mathematical model, analyze and design the computer software component;
	1-4 Use the professional knowledge and principles of computer science to build solutions to practical problems;
<p>Requirement 2: Problem analysis: be able to apply the basic principles of mathematics, natural science and engineering science to identify, express and analyze complex engineering problems in computer software, software engineering and other related fields through literature research, so as to obtain effective conclusions.</p>	2-1. Be able to use mathematics, natural science and professional knowledge to identify and judge complex engineering problems in computer software, software engineering and other related fields;
	2-2. Be able to express complex engineering problems in computer software, software engineering and other related fields based on mathematics, natural science and professional knowledge;
	2-3. Be able to recognize that there are many solutions to problems and seek alternative solutions;
	2-4. Through literature research, analyze and screen out solutions to complex engineering problems in computer software, software engineering and other related fields;
<p>Requirement 3: Design / development solutions: be able to design solutions to complex engineering problems in computer software, software engineering and other related fields, design software systems, components or project development processes to meet specific needs, and be able to reflect the sense of innovation in the design process, taking into account social, health, safety, legal, cultural and environmental factors.</p>	3-1. Master the basic design / development methods and technologies of the whole cycle and process of engineering design and system development in computer software, software engineering and other related fields;
	3-2. Be able to complete the design of computer software system components according to the specific needs of computer software, software engineering and other related fields, and embody the sense of innovation in the design;
	3-3. In the design, safety, law, culture, environment and other constraints can be considered;
<p>Requirement 4: Research: be able to study complex engineering problems in computer software, software engineering and other related fields based on scientific principles and scientific methods, including designing experiments,</p>	4-1. Based on the principles of computer science, be able to use literature to establish corresponding research models for complex engineering problems in computer software, software engineering and other related fields, and meet the basic requirements of system development and engineering;
	4-2. According to the research model, put forward their own research ideas, and design a practical simulation or experimental scheme;

analyzing and interpreting data, and getting reasonable and effective conclusions through information synthesis.	4-3. Be able to carry out experiments according to the experimental scheme, analyze and interpret the experimental data and get reasonable and effective conclusions through information synthesis.
Requirement 5: Using modern tools: be able to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for complex engineering problems in computer software, software engineering and other related fields, including prediction and simulation of complex software engineering and related fields, and understand their limitations.	5-1. Understand the performance and adaptability of common development environment and development tools, as well as their adaptability to development and analysis; be able to apply them correctly;
	5-2. Be able to select and use appropriate development tools to design, calculate and analyze specific objects, and understand their limitations;
	5-3. Be able to select modern tools to meet specific needs and simulate professional problems in computer and related fields for complex engineering problems in computer software, software engineering and other related fields.
Requirement 6: Engineering and society: be able to make reasonable analysis based on the relevant background knowledge of computer software, software engineering and other related fields, evaluate the impact of software engineering professional engineering practice and complex engineering problem solutions in computer software, software engineering and other related fields on society, health, safety, law and culture; understand the responsibilities.	6-1. Be able to understand the relevant abilities required for engineering training in the field of software engineering;
	6-2. Understand the background knowledge and technical standard system of computer software, software engineering and other related fields; Understand the laws, regulations and industrial policies related to computer software and software engineering;
	6-3. Be able to evaluate the possible impact of software engineering practice on society, safety, law and culture; understand the responsibilities.
Requirement 7: Environment and sustainable development: be able to understand and evaluate the impact of engineering practice aiming at complex engineering problems in computer software, software engineering and other related fields on environment and social sustainable development.	7-1. Have the consciousness of environmental protection and sustainable development; Understand the guidelines and policies, laws and regulations related to environmental protection and sustainable development;
	7-2. Be able to understand the sustainability of practical solutions and engineering practice, understand and evaluate the solutions of complex engineering problems in computer software, software engineering and other related fields, and the impact of software engineering professional engineering practice on the sustainable development of environment and society.
Requirement 8: Professional norms: have humanities and social science literacy, sense of social responsibility, be able to understand and abide by engineering professional ethics and norms in engineering practice; fulfill	8-1. Have basic humanistic and social literacy, be able to use historical and philosophical knowledge and methods to understand and analyze social phenomena, understand the relationship between individuals and society, and understand China national conditions;
	8-2. Be able to have healthy constitution, correct values, good psychological quality and sense of social responsibility;
	8-3. Understand the honest, fair, honest and trustworthy professional ethics and norms,

responsibilities.	and consciously abide by it, and understand the social responsibility of engineers in computer software, software engineering and other related fields to the public.
Requirement 9: Individual and team: be able to play the role of individual, team member and leader in a multidisciplinary team.	9-1. Be clear about the role composition and responsibility division of the team under the multi-disciplinary background, have the sense of teamwork, be able to put forward their own ideas and listen to the opinions and suggestions of other members; 9-2. Be able to communicate with other team members effectively, take on the role of individual, team member and leader in the team, and complete the tasks assigned by the team.
Requirement 10: Communication: be able to effectively communicate with peers and the public on complex engineering problems in computer software, software engineering and other related fields, including writing reports and design manuscripts, making statements, clearly expressing or responding to instructions. And have a certain international vision, be able to communicate and exchange in the cross-cultural background.	10-1. Be able to clearly express complex engineering problems in computer software, software engineering and other related fields with technical documents such as manuscripts or drawings; 10-2. Be able to use modern information technology to communicate with peers in the industry and the public on complex engineering problems in computer software, software engineering and other related fields through manuscripts, drawings and other technical documents; 10-3. Understand the hot issues and international situation of software engineering related industries; 10-4. Have the basic ability of listening, speaking, reading, writing and translating in a foreign language, be able to read foreign materials in the field of software engineering, have a certain international vision, and be able to communicate and exchange under the cross-cultural background..
Requirement 11: Project management: understand and master the principles of project management and economic decision-making methods in the fields of computer software and software engineering, and be able to apply them in a multidisciplinary environment.	11-1. Be able to understand and master the management principles and economic decision-making methods of software engineering; 11-2. Be able to use the methods of engineering management and economic decision-making in the process of software engineering solution design.
Requirement 12: Lifelong learning: have the consciousness of self-learning and lifelong learning, have the ability of continuous learning and adapting to development.	12-1. Have the consciousness of self-learning and lifelong learning; 12-2. Have the ability of autonomous learning, including the ability to understand technical problems, the ability to summarize and solve problems.

## The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives			
	Educational Objectives 1	Educational Objectives 2	Educational Objectives 3	Educational Objectives 4
1: Engineering Knowledge		√		
2: Problem Analysis		√		
3: Design/Development Solutions	√	√	√	
4: Research		√	√	
5: Use Modern Tools		√	√	
6: Engineering and Society	√		√	
7: Environment and Sustainable Development	√			
8: Career Planning	√			√
9: Individuals and Teams			√	
10: Communication			√	√
11: Project Management				
12: Lifelong Learning				√

### IV. Major Subject

Software Engineering

### V. Core Courses

C Programming Language I, Object-Oriented Programming, Algorithm and Data Structures, Operating System, Principle of Database System, Compiler Construction Principles, Computer Networking, Computer Organization and Architecture, Software Engineering, Software Quality Assurance and Project Management, UML and System Analysis and Design Techniques.

### VI. Educational System

The basic length of undergraduate education is 2 years, and the flexible study period is 2-4 years. It is managed according to the credit system.

### VII. Confer Degrees

Students should complete at least 86.5 credits before graduation. The Bachelor of engineering degree can be granted to those who meet the degree awarding requirements of the relevant regulations on the awarding of bachelors degree for graduates of Shenyang University of Chemical Technology (revised in March 2017).

## VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit requirement	Subtotal	Proportion (%)
General Education	General Education (Compulsory)	Ideological and Political Courses	Compulsory	10	21	24.28
		Foreign Language Courses		6		
		Military and Safety Courses		2		
		Labor and Sport Education		1		
		Innovation and Entrepreneurship		1		
		Mental Health		1		
	General Education (Optional)	Aesthetic Education(400)	Optional	1	5	5.78
		China and the World(500)		1		
		Four Histories(600)		1		
		Economic Management(700)		1		
Traditional Culture(900)		1				
General Education (Practice)	Military training	Practice	2	2	2.31	
Discipline Education	Basic Courses	Public Basic Class	Compulsory	24	24	27.75
		Professional Foundation				
	Basic Practice Sessions	-	Practice			
Specialized Education	Core Courses	-	Compulsory	8.5	30.5	35.26
	Optional Courses	-	Optional	2		
	Specialized Practice Sessions	-	Practice	20		
Competency Development	Individualized Courses	-	Compulsory (or Practice)	4	4	4.62
Extracurricular links	Extracurricular General Education Practice	Culture and Society Practice	Extracurricular Practice	4		
		Mentally and Physically Practice				
		Foreign Language Proficiency Training Practice				
	Extracurricular Characteristic Practice	Innovative Training		4		
		Innovation Competition				
		Chuangke Activities				
	Career Education	Growth Planning Courses		1		
Total/Proportion					86.5	100%



## 九、软件工程专业教学进程表

### Table of Teaching Schedule for Software Engineering Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes	
							讲课 Lec.e	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th		
通识教育课 General Education	必修 Compulsory	思政类 Ideological and Political Courses	0710053003	中国近现代史纲要   Outline of Chinese Contemporary and Modern History	3.0	48	32			16	2					
			0710103003	马克思主义基本原理*   Basic Principles of Marxism*	3.0	48	32			16		2				
			0710123001	习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8		3				
			0710011303	形势与政策   Current Situation and Policies	1.0	32	32				1	1	1	1		
		外语类 Foreign Language Courses	0211003103	大学外语I   College English I	3.0	48					3					
			0211003203	大学外语II   College English II	3.0	48						3				
		军事安全类 Military and Safety Courses	0710081003	军事理论   Military Theory	1.0	16					2					
			1618041004	安全教育   Safety Education	1.0	16						2				
		劳动教育类 Labor Education	2640021003	劳动教育   Labour Education	1.0	16	16					2				

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes
							讲课 Lec.e	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	
通识教育课 General Education	必修 Compulsory	创新创业类 Innovation and Entrepreneurship courses	1651001404	创造性思维与创新方法   Creative Thinking and Innovative Methods	1.0	16					2				
		心理健康类 Mental Health Courses	0510041003	大学生心理与健康教育   Mental and Health Education for College Students	1.0	16	16				2				
		小计 Subtotal			21	352	170	0	0	40	7	13	0	1	
	选修 Optional	分为经济管理类、美育类、四史、传统文化、中国与世界课程类 6 个模块 每个模块最多选修 2.0 学分，每学期最多选修 2 门课程。 Including 6 modules: Economic Management, Aesthetic Education, Science and Technology, Four Histories, Traditional Chinese Culture, China and The world. Up to 2.0 credits per module and up to 2 courses per semester.													
	小计 Subtotal			5				1		4					
	实践 Practice	0415102013	军训   military training	2.0	48				48	+2				必选	
合计 Total					28	400	170	0	0	88	9	13	0	1	
学科平台课 Discipline Education	必修 Compulsory	数学与自然科学类 Natural Science & Mathematics	0310002103	高等数学 I*   Advanced Mathematics I*	2.0	32					2				
			0310002203	高等数学 II*   Advanced Mathematics II*	2.0	32					2				
		工程基础类 Foundation Engineering	1612021004	工程导论   Introduction to Engineering	1	16	16				2				
			1612051004	文献检索与科技论文写作   Literature Retrieval and Writing of Scientific Papers	1	18	12	6					1		

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes	
							讲课 Lec.e	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th		
学科平台课 Discipline Education	必修 Compulsory	专业基础类 Subject Foundation Requisite	1618082004	算法与数据结构*   Algorithm and Data Structure*	2.5	44	32	12			2					
			1610132004	操作系统*   Operating System*	2.0	32	32				2					
			1610142004	计算机网络*   Computer Network*	2.5	44	32	12			2					
			1610092004	计算机组成原理*   Principles of Computer Organization*	2.5	44.0	32	12				2				
			1618073004	面向对象程序设计   Object-Oriented Programming	3.0	56.0	32	24			2					
			1618122004	数据库系统原理   Principle of Database System	2.5	44.0	32	12			2					
			1610152004	软件工程    Software Engineering	2.0	32.0	32					2				
			小计 Subtotal				23	394	316	78	0	0	13.5	8.5		1
	实践 Practice			1613761024	算法与数据结构实践    Practices for Algorithm and Data Structures	1	24						2			
				小计 Subtotal			1	24						1		
合计 Total					24	418	252	78	0	0	13.5	9.5	1	0		
专业教育课 Specialized Education	必修 Compulsory		1620732004	UML 与系统分析设计*   UML and System Analysis and Design Techniques*	2.5	48	24	24					2			

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes	
						讲课 Lec.e	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th		
专业教育课 Specialized Education	必修 Compulsory	1620741004	软件质量保障与项目管理*   Software Quality Assurance and Project Management*	1.5	24	24						4			
		1610892004	网络工程技术竞赛   Network Engineering Technology Competition	2	44	8	36				2				
		1613772004	编译原理*   Compiler Principles*	2.5	44	32	12				2				
		小计 Subtotal			8.5	160	88	72	0	0	0	7	1.5	0	
	选修 Optional	1632832004	数学竞赛   Mathematics Competition	2	32	32							2		
		1632842004	专业技术竞赛   Professional Technology Competition	2	32	32							2		
		1633222004	人工智能导论   Introduction of Artificial Intelligence	2	32	32							2		
		1638002004	Python 语言   Python Language	2	40	16	24				2				
		1650752104	程序设计竞赛 I   Programming Competition I	2.5	48	24	24				2				
		1637102004	移动应用开发技术    Mobile Application Development Technology	2	36	24	12					2			
		小计 Subtotal			2	220	160	60	0	0	2	0	0	0	
	(专业选修课学分必须满 2 学分以上 Professional elective credits must be more than 2 credits)														

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes	
							讲课 Lec.e	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th		
专业教育课 Specialized Education	实践 Practice		1612801024	C 语言实践   Practices for C Language	1.5	36		36			2					
			1615441024	软件测试与项目管理实践   Practice for Software Testing and Project Management	1.5	36							6			
			1615232034	生产实习   Production practice	2									+2		集中
			1615401024	软件工程实践    Practice for Software Engineering	1	24						2				
			1617031044	毕业设计（论文）   Graduation Design（Thesis）	14										+14	集中
			小计 Subtotal			20	96	0	36	0	0	1.5	1	3.5	14	
合计 Total					30.5	632	344	228	0	0	3.5	8	5	14		
能力拓展课 Competency Development	必修或实践 Compulsory or Practice		1615254024	专业综合实践   Professional comprehensive practice	4	96		96					12			
			小计 Subtotal			4	96	0	96	0	0	0	0	4	0	
			(此处填写修读要求 Fill in the Study Requirements)													
总计 Sum					86.5	1546	766	402	0	88	27	30.5	14	15		
课外环节 Extracurricular links	课外实践 Extracurricular practice	人文社会实践 Culture and Society Practice	1614010014	社会调查   Social Survey	0.5	12				12					分散	
		身心健康社会实践 Mentally and Physically Practice	0415102013	课外体育锻炼   Extracurricular Physical Exercise	0.5	12				12					分散	
			2640030013	劳动教育实践   Labour Education Practice	0.5	12				12		0.5			分散	

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes
							讲课 Lec.e	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	
课外环节 Extracurricular links	课外实践 Extracurricular practice		0510070313	心理健康辅导   Mental Health Counseling	0.5	12				12					分散
		外语技能实践类 Foreign Language Proficiency Training Practice	0210010013	外语技能实践（初级）   Foreign Language Proficiency Training Practice (elementary)	2.0	48				48				2	(2 选 1) 分散
			0210020013	外语技能实践（高级）   Foreign Language Proficiency Training Practice (advanced)	2.0	48				48				2	
		能力与创新实践 Capability and Innovation Practice	1615494014	大学生素质拓展与创新实践   Quality Development and Innovation Practice	4.0	96				96	1~8 学期依据《沈阳化工大学创新创业实践学分认定办法》由创新创业学院认定				分散
		成长规划类 Growth Planning Courses	1617601304	职业规划与就业指导   Career Planning and Employment Guidance	1.0	40	40				1				分散
小计 Subtotal															

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理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5，课程名称中画\*为考试课。

Note: "Cre. (Credits)", "T.C.H. (Total Credit Hours)", "Lec. (Lecture)", "Exp. (Experiment)", "Pro. (Programming)", "Pra. (Practice)".

## 十、软件工程专业学士学位课程一览表

### A list of bachelor's degree programs in Software Engineering

课程类别 Course Type	模块名称 Modules	序号 No.	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester
通识教育课 General Education	思政类 Ideological and Political Courses	1	0710103003	马克思主义基本原理*   Basic Principles of Marxism*	3	2
学科平台课 Discipline Education	数学与自然 科学类 Natural Science & Mathematics	2	0310002103	高等数学 I*   Advanced Mathematics I*	2	1
		3	0310002203	高等数学 II*   Advanced Mathematics II*	2	2
	专业基础 Subject Foundation Requisite	4	1610082004	算法与数据结构**   Algorithm and Data Structure*	2.5	1
		5	1610132004	操作系统*   Operating System*	2.5	2
		6	1610142004	计算机网络*   Computer Network*	2.5	1
		7	1610092004	计算机组成原理*   Principles of Computer Organization*	2.5	2
		8	1618073004	面向对象程序设计   Object-Oriented Programming	3	1
		9	1618122004	数据库系统原理*   Principle of Database System*	2.5	1
		10	1610152004	软件工程*   Software Engineering	2	2
		专业教育课 Specialized Education	必修 Compulsory	11	1620732004	UML 与系统分析设计*   UML and System Analysis and Design Techniques*
12	1620741004			软件质量保障与项目管理*   Software Quality Assurance and Project Management*	1.5	3
13	1613772004			编译原理*   Compiler Construction Principles*	2.5	2

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》

### 十一、全学程实践环节周历安排 Weekly Calendar of all Practice Sessions

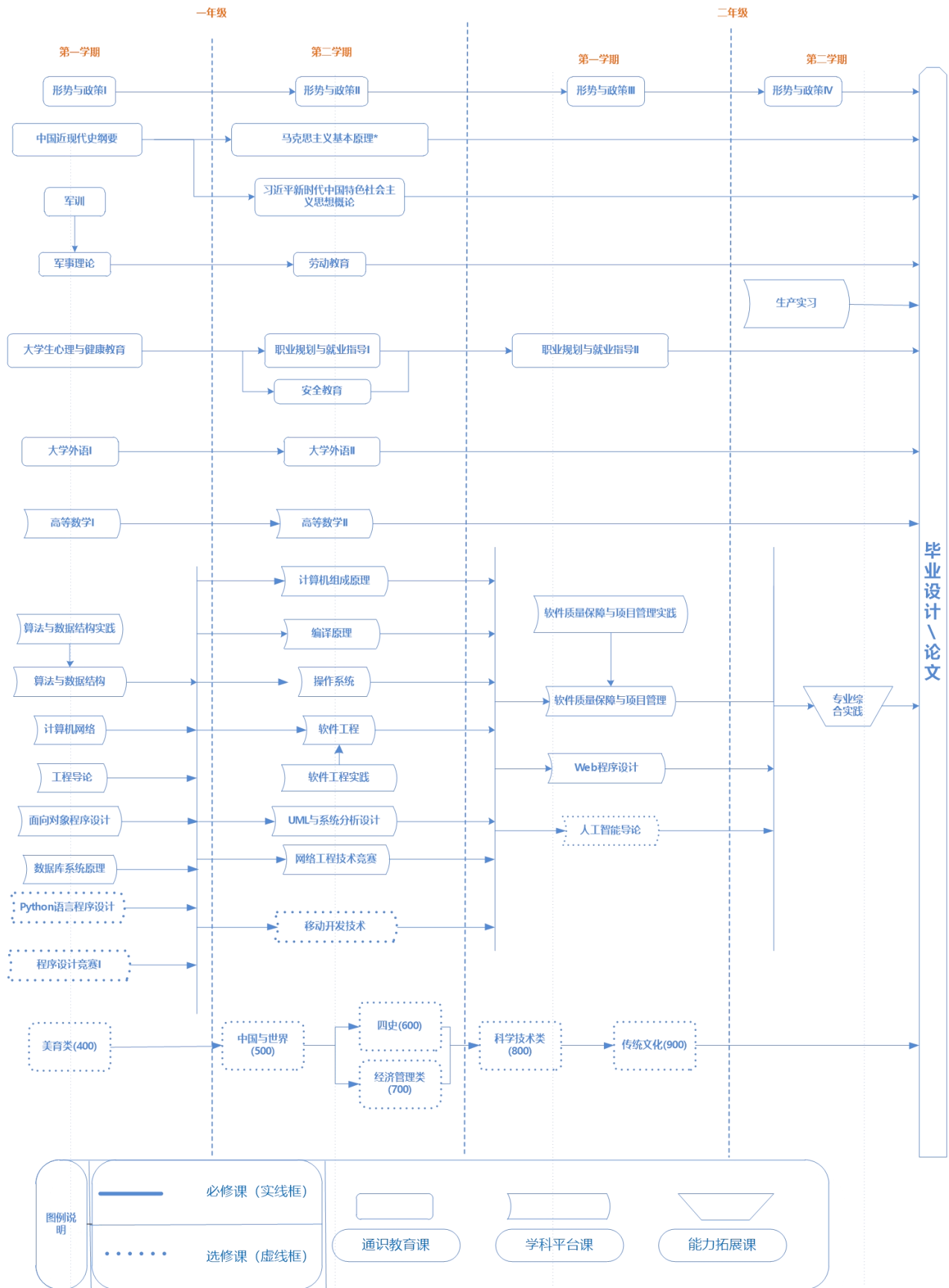
学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注	
一																		::	::	·			
二																		::	::	·			
三							/	/										::	::	·			
四	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=		

符号说明(Symbol Description):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P 各类实训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计(论文)  
||Graduation Project(Thesis)    ·小学期||Primary Term



## 十二、课程体系配置图 Curriculum System Configuration Diagram



十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements (High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																				
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	12.2		
马克思主义基本原理*   Basic Principles of Marxism*																							L	H													
习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																							L	H													
中国近现代史纲要   Outline of Chinese Contemporary and Modern History																								H													
形势与政策   Current Situation and Policies											H								H		M		H														
大学外语I-II    College English I-II																																	H				
军事理论   Military Theory																								M													
安全教育   Safety Education																																					
劳动教育   Labour Education																																					
创造性思维与创新方法   Creative Thinking and Innovative Methods											L																L				M						
职业规划与就业指导   Career Planning and Employment Guidance																										H	H	L									



课程 (Courses)	毕业能力要求 (Graduation Requirements)																																			
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	10.4	11.1	11.2	12.1	12.2	
编译原理*   Compiler Principles*			H			H																														
计算机网络*   Computer Network*				H								H							M																	
操作系统*   Operating System*				H	H		L					H																								
软件工程    Software Engineering						H		H		H										H		H											H			
算法与数据结构实践    Practices for Algorithm and Data Structures		H											H																							
软件工程实践    Practice for Software Engineering										H			H															H								
软件测试与项目管理实践   Practice for Software Testing and Project Management																H							M													
毕业设计 (论文)   Graduation Design (Thesis)						M	H			M		M	H		H					H										H	H		H		H	
专业综合实践   Professional comprehensive practice							H			M		M	H														H		H							H
软件质量保障与项目管理*   Software Quality Assurance and Project Management*																M							H											H		

# 沈阳化工大学专升本培养方案

## 计算机科学与技术学院

专业名称：网络工程

专业代码：080903

制 定：刘 俊

审 核：张 波

审 定：于三三

批 准：金志浩

2021 年 8 月

# 网络工程专业（专升本）培养方案

## 一、培养目标

本专业培养德、智、体、美、劳全面发展，能够运用数学、自然科学和计算机科学的基础知识，综合运用网络工程领域的科学理论及应用技术，从事网络系统规划与设计、实施与运维、网络安全保障、网络应用开发或相关 IT 工程技术实践。毕业生能在信息技术企业或其他各行各业中信息技术部门和管理部门，独立胜任网络软件工程师、系统集成工程师和网络安全工程师等岗位职责和技术要求的高素质应用型人才。

本专业毕业生具有如下目标预测：

（1）具备较好的人文社会科学素养，高度的社会责任和良好的工程职业道德；具备良好的沟通与表达能力和团队协作精神；

（2）能够将数学、自然科学与计算机科学的基础知识和技术运用于网络工程实践活动，从而具备解决现实世界中的复杂网络工程问题的能力；

（3）具备网络工程的专业思想与工程能力，将网络工程领域的知识、技术和方法运用于现实世界中的复杂网络工程实践中；

（4）具备网络应用系统设计与开发、网络工程系统规划与设计、网络系统实施与运维，以及网络安全保障能力，并能在复杂网络工程实践中得到应用；

（5）能够具备创新和创业意识，具有良好职业发展力和适应力；

## 二、专业方向

网络工程

## 三、毕业要求

本专业毕业生在毕业时，应该具备较强的社会责任感和基本人文素养；理解与掌握数学、自然科学和计算机科学的理论知识；理解和掌握复杂网络工程领域的规划与设计原理、应用系统开发流程、网络安全实施的原理等知识，接受科学思维和科学实验的基本训练；接受从事研究与应用计算机网络的基本训练，在网络规划设计、网络管理与网络安全、网络应用系统开发和网络工程测试等方面具有较宽的工程技术基础和一定的专业知识。具有较强的相关技术处理能力和一定的系统分析能力；了解本专业的发展方向和最新成就，具有较强的自学能力和不断更新知识的能力；较熟练掌握一门外语。

毕业能力要求及其指标点分解：

毕业能力要求	指标点
毕业要求 1： 工程知识 能够将数学、自然科学、工程基础和计算机科学知识用于解决复杂网络工程问题	1-1.掌握数学与自然科学知识、方法与思想，并用于复杂网络工程过程中的抽象思维和逻辑分析
	1-2.掌握计算机学科的基础知识、基本方法和基本思想，并用于复杂网络工程过程中，网络系统和相关算法方面的构思、分析与设计
	1-3.掌握网络工程领域的基本知识、基本方法和工程思想，用于复杂网络工程过程中，网络系统的规划与实施、运维与管理、网络安全、应用系统设计与实施等方面的构思、设计、实施与分析
毕业要求 2：问题分析	2-1. 掌握数学、物理和计算机科学的基本原理，在复杂网络工程问题的识别和判断过程中展示

能够应用数学、自然科学和计算机科学的基本原理, 识别、表达、并通过文献研究分析复杂网络工程问题, 以获得有效结论	科学思维能力
	2-2. 能根据数学、物理和计算机科学的基本原理, 正确表达复杂网络工程的关键问题
	2-3. 能利用文献资料进行分析和研究, 并能得出有效的结论
毕业要求 3: 设计解决方案 能够设计针对复杂网络工程问题的解决方案, 包括满足特定需求的网络系统设计、部件选择、工程实施流程或方案设计, 并能够在设计环节中体现创新意识, 考虑社会、健康、安全、法律、文化以及环境等因素	3-1. 掌握网络工程领域规划与设计、管理与维护、安全与保障、软件分析与设计的基本设计/开发方法和技术
	3-2. 能根据工程实践学习经历设计出复杂网络工程问题的解决方案
	3-3. 根据解决方案, 能针对某个特定需求完成部件选择、部件设计、工程实施过程等, 并能体现创新意识
	3-4. 理解社会、健康、安全、法律、文化和环境对于复杂网络工程解决方案得影响, 并得出有效结论
毕业要求 4: 问题研究 能够基于科学原理并采用科学方法对复杂网络工程问题进行研究, 包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论	4-1. 掌握网络工程领域的科学原理和科学方法, 并能在研究复杂网络工程问题中得到运用
	4-2. 针对研究的内容, 提出研究思路和实验方法, 并能够设计实验过程、收集实验数据
	4-3. 针对研究内容和实验结果, 综合分析实验数据, 并给出合理有效得结论
毕业要求 5: 使用现代工具 能够针对复杂网络工程问题, 开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具, 包括对复杂工程问题的预测与模拟, 并能够理解其局限性	5-1. 能够选择和利用基本的信息技术工具和网络工程工具, 结合适当的技术与资源, 用于复杂网络工程问题的预测与分析
	5-2. 能够针对复杂网络工程问题, 选择恰当的虚拟仿真工具或方法, 对网络系统或其解决方案进行必要的模拟与预测, 并能够理解仿真模拟系统与真实系统之间的差异
	5-3. 能够使用恰当的技术、资源对现代工程工具和信息技术工具进行开发, 解决复杂网络工程中特定的问题, 解决各个部件之间的接口与联系, 并能够理解其局限性
毕业要求 6: 工程与社会 能够基于网络工程相关背景知识进行合理分析, 评价网络工程实践和复杂工程问题解决方 案对社会、健康、安全、法律以及文化的影响, 并理解应承担的责任	6-1. 能够了解互联网和信息安全相关的法律、法规, 并理解网络系统或网络工程实践对于社会、健康、安全、法律以及文化的可能影响
	6-2. 能够基于网络工程专业知识, 结合相关的应用背景知识, 评价网络系统解决方案或网络工程实践对于社会、健康、安全、法律以及文化的可能影响, 并理解应承担的责任
毕业要求 7: 环境和可持续发展 能够理解和评价针对复杂网络工程问题的工程实践对环境、社会可持续发展的影响	7-1. 具有环境保护的自觉和可持续发展的意识; 了解环境保护与可持续发展相关的方针与政策、法律与法规
	7-2. 能够理解实际解决方案和工程实践的可持续性, 理解和评价复杂网络工程工程问题的解决方案和网络工程专业工程实践对环境、社会可持续发展的影响
毕业要求 8: 职业规范 具有人文社会科学素养、社会责任感, 能够在网络工程实践中理解并遵守工程职业道德和规范, 履行责任	8-1. 具有基本的人文社会素养, 能够运用历史、哲学的知识和方法认识、分析社会现象, 理解个人与社会的关系, 了解中国国情
	8-2. 能够拥有健康的体质, 具有正确的价值观, 具有良好的心理素质和责任感
	8-3. 理解诚实公正、诚实守信的网络工程领域的工程职业道德和规范, 并能自觉遵守, 理解网络工程领域工程师对公众的社会责任
毕业要求 9: 个人和团队 能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色	9-1. 在多学科背景下明确团队的角色构成和职责分工, 能够具有团队合作意识, 能够提出自己的想法并且倾听其他成员的意见和建议
	9-2. 能够与团队其他成员有效沟通, 能够在团队中承担个体、团队成员以及负责人的角色, 并完成团队分配的任务
毕业要求 10: 沟通 能够就复杂网络工程问题与业界同行及社会公众进行有效沟通和交流, 包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。并具	10-1. 具备沟通交流的基本技巧与能力, 良好的口头与书面表达能力, 有效表达自己思想与意愿的能力, 倾听与理解他人需求和意愿的能力, 适应工作与人际环境变化的能力
	10-2. 能够依照相关的工程标准或行业规范, 进行网络工程相关技术问题及文档(如需求分析报告、系统设计方案、系统实施方案等)的书面表达和口头交流

备一定的国际视野，能够在跨文化背景下进行沟通和交流	10-3. 具备一门外国语的基本听、说、读、写、译能力，能够阅读网络工程专业领域的外文资料，并具备一定的国际视野，能够在跨文化背景下进行沟通和交流
毕业要求 11：项目管理 理解并掌握工程管理原理与经济决策方法，并能在多学科环境中应用	11-1. 能够理解和掌握网络工程的管理原理和经济决策方法
	11-2. 能够在解决网络工程方案设计过程中，运用工程管理和经济决策的方法
毕业要求 12：终身学习 具有自主学习和终身学习的意识，有不断学习和适应发展的能力	12-1. 具有自主学习和终身学习意识
	12-2. 具有自主学习的能力，包括对技术问题的理解能力、归纳总结的能力和解决问题的能力

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。

### 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标				
	培养目标 1	培养目标 2	培养目标 3	培养目标 4	培养目标 5
1: 工程知识		R			
2: 问题分析		R	R	R	
3: 设计/开发解决方案			R	R	
4: 研究			R	R	
5: 使用现代工具		R	R	R	R
6: 工程与社会	R				
7: 环境和可持续发展	R				
8: 职业规范	R				
9: 个人和团队	R				
10: 沟通	R				
11: 项目管理					R
12: 终身学习					R

## 四、 主干学科

计算机科学与技术

## 五、 专业核心课程

计算机组成原理、算法与数据结构、操作系统、计算机网络、面向对象程序设计、数据库系统原理、网络编程技术、网络安全技术、物联网技术概述

## 六、 修业年限

本科基本学制 2 年，弹性学习年限 2-4 年，按照学分管理制度管理。

## 七、 授予学位

学生应至少修满 88 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者，可授予工学学士学位。



## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例(%)
通识教育课	通识教育必修课	思政类	必修	10	21	23.86
		外语类		6		
		军事安全类		2		
		劳动教育类		1		
		创新创业类		1		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	1	5	5.68
		中国与世界(500)		1		
		四史(600)		1		
		经济管理类(700)		1		
		传统文化(900)		1		
通识教育实践课	军训	实践	2	2	2.27	
学科平台课	学科基础课程	公共基础类	必修	26	26	29.55
		专业基础类				
	学科实践课程	-	实践			
专业教育课	专业核心课程	-	必修	8.5	30	34.09
	专业选修课程	-	选修	2		
	专业实践课程	-	实践	19.5		
能力拓展课	专业特色课程	-	必修 (或实践)	4	4	4.55
课外环节	课外通识实践	人文社会实践	课外实践	4		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
	生涯教育	成长规划类		1		
总学分/比例					88	100%

# Network Engineering Major 2021 Undergraduate Education Program

## I. Educational Objectives

This major cultivates students with all-round development in morality, intelligence, sports, beauty and labor, who can use the basic knowledge of mathematics, natural science and computer science, comprehensively use the scientific theory and application technology in the field of network engineering, and engage in network system planning and design, implementation, operation and maintenance, network security, network application development or related it engineering technology practice. Graduates can work independently in information technology department and management department enterprises or other industries as competent network software engineer, system integration engineer and network security engineer with post responsibilities and technical requirements of high-quality application-oriented talents.

Graduates should obtain knowledge and competences as follows:

(1) Have a good humanities and social science literacy, a high degree of social responsibility and good engineering ethics; Good communication and expression skills and teamwork spirit;

(2) Be able to apply the basic knowledge and technology of mathematics, natural science and computer science to network engineering practice, so as to have the ability to solve complex engineering problems in the real world;

(3) Have the professional thought and engineering ability of network engineering, and apply the knowledge, technology and methods in the field of network engineering to the practice of complex network engineering in the real world;

(4) Have the ability of network application system design and development, network engineering system planning and design, network system implementation and operation and maintenance, and network security, and can be applied in engineering practice;

(5) Be able to be innovative and entrepreneurial, with good career development and adaptability

## II. Major Direction

Network Engineering

## III. Graduation Requirements

Graduates of this major should have a strong sense of social responsibility and basic humanistic quality when they graduate; Understand and master the theoretical knowledge of mathematics, natural science and computer science; Understand and master the planning and design principles, application system development process, network security implementation principles and other knowledge in the field of complex network engineering, and accept the basic training of scientific thinking and scientific experiments; Accept the basic training of research and application of computer network, have a wide engineering technology foundation and certain professional knowledge in network planning and design, network management and network security, network application

system development and network engineering testing. Have strong ability of relevant technology processing and system analysis; understand the development direction and latest achievements of the major; have strong self-learning ability and the ability to constantly update knowledge; Master a foreign language well.

Graduates should obtain knowledge and competences as follows:

Graduation Requirements	Indices
<p>Requirement 1: Engineering Knowledge Be able to use mathematics, natural science, engineering foundation and computer science knowledge to solve complex network engineering problems</p>	1-1. Master the knowledge, methods and ideas of mathematics and natural science, and apply them to abstract thinking and logical analysis in the process of complex network engineering
	1-2. Master the basic knowledge, basic methods and basic ideas of computer science, and apply them to the conception, analysis and design of network system and related algorithms in the process of complex network engineering
	1-3. Master the basic knowledge, basic methods and engineering ideas in the field of network engineering, and apply them to the conception, design, implementation and analysis of network system planning and implementation, operation and maintenance and management, network security, application system design and implementation in the process of complex network engineering.
<p>Requirement 2: Problem Analysis Be able to apply the basic principles of mathematics, natural science and computer science to identify, express and analyze complex network engineering problems through literature research, so as to obtain effective conclusions</p>	2-1. Master the basic principles of mathematics, physics and computer science, and demonstrate the ability of scientific thinking in the process of identifying and judging complex network engineering problems
	2-2. Be able to correctly express the key problems of complex network engineering according to the basic principles of mathematics, physics and computer science
	2-3. Be able to analyze and research with literature and draw effective conclusions
<p>Requirement 3: Design/Development Solutions Be able to design solutions for complex network engineering problems, including network system design, component selection, project implementation process or scheme design to meet specific needs, and be able to reflect the sense of innovation in the design process, considering social, health, safety, legal, cultural and environmental factors</p>	3-1. Master the basic design / development methods and technologies of network engineering planning and design, management and maintenance, security and assurance, software analysis and design
	3-2. Be able to design solutions to complex network engineering problems according to engineering practice and learning experience
	3-3. According to the solution, be able to complete the component selection, component design, engineering implementation process, etc. for a specific demand, and embody the innovation consciousness
	3-4. Understand the impact of society, health, safety, law, culture and environment on complex network engineering solutions and draw effective conclusions
<p>Requirement 4: Research Based on scientific principles and scientific methods, we can study complex network engineering problems, including designing experiments, analyzing and interpreting data, and getting reasonable and effective conclusions through information synthesis</p>	4-1. Master the scientific principles and methods in the field of network engineering, and be able to apply them in the study of complex network engineering problems
	4-2. According to the research content, put forward research ideas and experimental methods, and be able to design the experimental process and collect experimental data
	4-3. According to the research content and experimental results, comprehensively analyze experimental data give reasonable and effective

	conclusions
<p>Requirement 5: Use Modern Tools</p> <p>Be able to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for complex network engineering problems, including prediction and simulation of complex engineering problems, and understand their limitations</p>	5-1.Be able to select and use basic information technology tools and network engineering tools, combined with appropriate technologies and resources, to predict and analyze complex network engineering problems
	5-2. Be able to select appropriate virtual simulation tools or methods for complex network engineering problems, conduct necessary simulation and prediction for network system or its solutions, and understand the differences between simulation system and real system
	5-3.Be able to use appropriate technology and resources to develop modern engineering tools and information technology tools, solve specific problems in complex network engineering, solve interfaces and connections between various components, and understand their limitations
<p>Requirement 6: Engineering and Society</p> <p>Be able to make reasonable analysis based on the relevant background knowledge of network engineering, evaluate the impact of network engineering practice and complex engineering problem solutions on society, health, safety, law and culture, and understand the responsibilities</p>	6-1.Be able to understand the laws and regulations related to Internet and information security, and understand the possible impact of network system or network engineering practice on society, health, safety, law and culture
	6-2. Be able to evaluate the possible impact of network system solutions or network engineering practices on society, health, safety, law and culture based on network engineering professional knowledge and relevant application background knowledge, and understand the responsibilities to be undertaken
<p>Requirement 7: Environment and Sustainable Development</p> <p>Be able to understand and evaluate the impact of engineering practice on the sustainable development of environment and society</p>	7-1.Have the consciousness of environmental protection and sustainable development; Understand the guidelines, policies, laws and regulations related to environmental protection and sustainable development
	7-2. Be able to understand the sustainability of practical solutions and engineering practices, and understand and evaluate the impact of solutions to complex network engineering problems and network engineering professional engineering practices on environmental and social sustainable development
<p>Requirement 8: Career Planning</p> <p>Have humanities and social science literacy, sense of social responsibility, be able to understand and abide by engineering professional ethics and norms in network engineering practice, and fulfill responsibilities</p>	8-1.Have basic humanistic and social literacy, be able to use historical and philosophical knowledge and methods to understand and analyze social phenomena, understand the relationship between individuals and society, and understand China's national conditions.
	8-2. Be able to have a healthy constitution, correct values, good psychological quality and sense of social responsibility
	8-3.Understand the engineering professional ethics and norms in the field of honest, just and trustworthy network engineering, and consciously abide by them, and understand the social responsibility of engineers to the public in the field of network engineering
<p>Requirement 9: Individuals and Teams</p> <p>Be able to play the role of individual, team member and leader in a multidisciplinary team</p>	9-1.Be clear about the role composition and responsibility division of the team under the multidisciplinary background, be able to have a sense of teamwork, be able to put forward their own ideas and listen to the opinions and suggestions of other members
	9-2. Be able to communicate with other team members effectively, take on the role of individual, team member and leader in the team, and complete the tasks assigned by the team

<p>Requirement 10: Communication</p> <p>Be able to effectively communicate with peers and the public on complex network engineering issues, including writing reports and design manuscripts, making statements, clearly expressing or responding to instructions; have a certain international vision; be able to communicate and exchange in the cross-cultural background</p>	10-1. Have the basic skills and ability of communication, good oral and written expression ability, the ability to effectively express their own thoughts and wishes, the ability to listen to and understand the needs and wishes of others, and the ability to adapt to the changes of work and interpersonal environment
	10-2. Be able to make written expression and oral communication of network engineering related technical problems and documents (such as requirement analysis report, system design scheme, system implementation scheme, etc.) in accordance with relevant engineering standards or industry specifications
	10-3. Have the basic ability of listening, speaking, reading, writing and translating in a foreign language, be able to read foreign materials in the field of network engineering, have a certain international vision, and be able to communicate and exchange under the cross-cultural background
<p>Requirement 11: Project Management</p> <p>Understand and master engineering management principles and economic decision-making methods, and be able to apply them in a multidisciplinary environment</p>	11-1. Be able to understand and master the management principles and economic decision-making methods of network engineering
	11-2. Be able to use engineering management and economic decision-making methods in the process of solving network engineering scheme design
<p>Requirement 12: Lifelong Learning</p> <p>Have the consciousness of self-learning and lifelong learning; have the ability of continuous learning and adapting to development</p>	12-1. Have the consciousness of self-learning and lifelong learning
	12-2. Have the ability of autonomous learning, including the ability to understand, summarize and solve technical problems

Graduates should obtain knowledge and competences as follows:

### The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives				
	Educational Objectives 1	Educational Objectives 2	Educational Objectives 3	Educational Objectives 4	Educational Objectives 5
1: Engineering Knowledge		R			
2: Problem Analysis		R	R	R	
3: Design/Development Solutions			R	R	
4: Research			R	R	
5: Use Modern Tools		R	R	R	R
6: Engineering and Society	R				
7: Environment and Sustainable Development	R				
8: Career Planning	R				
9: Individuals and Teams	R				
10: Communicate	R				
11: Project Management					R
12: Lifelong Learning					R

#### **IV. Major Subject**

Computer Science and Technology

#### **V. Core Courses**

Computer Composition Principle, Algorithm and Data Structure, Operating System, Computer Network, Object-oriented Programming, Database System Principle, Network Programming Technology, Network Security Technology, Overview of IoT Technology

#### **VI. Educational System**

The basic length of undergraduate education is 4 years, and the flexible study period is 3-6 years. It is managed according to the credit system

#### **VII. Confer Degrees**

Students should complete at least 88 credits before graduation. The Bachelor of engineering degree can be granted to those who meet the degree awarding requirements of the relevant regulations on the awarding of bachelor's degree for graduates of Shenyang University of Chemical Technology (revised in March 2017)

### VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit requirement	Subtotal	Proportion (%)
General Education	General Education (Compulsory)	Ideological and Political Courses	Compulsory	10	21	23.86
		Foreign Language Courses		6		
		Military and Safety Courses		2		
		Labor and Sport Education		1		
		Innovation and Entrepreneurship		1		
		Mental Health		1		
	General Education (Optional)	Aesthetic Education(400)	Optional	1	5	5.68
		China and the world(500)		1		
		Four Histories(600)		1		
		Economic Management(700)		1		
		Traditional Culture(900)		1		
General Education (Practice)	Military training	Practice	2	2	2.27	
Discipline Education	Basic Courses	Public basic class	Compulsory	26	26	29.55
		Professional foundation				
	Basic Practice Sessions	-	Practice			
Specialized Education	Core Courses	-	Compulsory	8.5	30	34.09
	Optional Courses	-	Optional	2		
	Specialized Practice Sessions	-	Practice	19.5		
Competency Development	Individualized Courses	-	Compulsory (or Practice)	4	4	4.55
Extracurricular links	Extracurricular General Education Practice	Culture and Society Practice	Extracurricular Practice	4		
		Mental and Physical Practice				
		Foreign Language Proficiency Training Practice				
	Extracurricular Characteristic Practice	Innovation Training		4		
		Innovation Competition				
		Chuangke activities				
	Career Education	Growth Planning Courses		1		
Total/Proportion					88	100%

## 九、网络工程专业教学进程表

### Table of Teaching Schedule for Network Engineering Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th		
通识教育课 General Education	必修 Compulsory	思政类 Ideological and Political Courses	0710053003	中国近现代史纲要   Outline of Chinese Contemporary and Modern History	3.0	48	32			16	2					
			0710103003	马克思主义基本原理*   Basic Principles of Marxism*	3.0	48	32			16		2				
			0710123001	习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8		3				
			0710011303	形势与政策   Current Situation and Policies	1.0	32	32					1	1	1	1	
		外语类 Foreign Language Courses	0211003103	大学外语I   College English I	3.0	48					3					
			0211003203	大学外语II   College English II	3.0	48						3				
		军事安全类 Military and Safety Courses	0710081003	军事理论   Military Theory	1.0	16					2					
			1618041004	安全教育   Safety Education	1.0	16					1	1	1			
		劳动教育类 Labor Education	2640021003	劳动教育   Labour Education	1.0	16	16					2				
		创新创业类 Innovation and Entrepreneurship courses	1651001404	创造性思维与创新方法   Creative Thinking and Innovative Methods	1	16						2				



课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th		
通识教育课 General Education	心理健康类 Mental Health Courses		0510041003	大学生心理与健康教育   Mental and Health Education for College Students	1.0	16	16				2					
	小计 Subtotal				21.0	320.0	138.0	0.0	0.0	40.0						
	选修 Optional		分为美育类(1.0)、经济管理类(1.0)、四史(1.0)、传统文化(1.0)、中国与世界(1.0)课程类5个模块 每个模块最多选修1.0学分,每学期最多选修2门课程。 Including 5 modules: Aesthetic Education(1.0),Economic Management(1.0),Four Histories(1.0), Traditional Chinese Culture(1.0), China and The World(1.0). Up to 1.0 credits per module and up to 2 courses per semester.													
	小计 Subtotal				5.0											
	实践 Practice		0415102013	军训   Military Training	2.0	48				48	+2					必选
合计 Total				28.0	368.0	138.0	0.0	0.0	88.0							
学科平台课 Discipline Education	数学与自然科学类 Natural Science & Mathematics		0310002103	高等数学 I*   Advanced Mathematics I*	2.0	32					2					
			0310002203	高等数学 II*   Advanced Mathematics II*	2.0	32						2				
	小计 Subtotal				4.0	64.0	0.0	0.0	0.0	0.0						
	工程基础类 Foundation Engineering		1612021004	工程导论   Introduction to Engineering	1	16	16				2					
			1612051004	文献检索与科技论文写作   Literature Retrieval and Writing of Scientific Papers	1	18	12	6					2			
小计 Subtotal				2.0	34.0	28.0	6.0	0.0	0.0							

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th		
学科平台课 Discipline Education	必修 Compulsory	专业基础类 Subject Foundation Requisite	1618082004	算法与数据结构**   Algorithm and Data Structure*	2.5	44	32	12			2					
			1610132004	操作系统*   Operating System*	2	32	32					2				
			1610142004	计算机网络*   Computer Network*	2.5	44	32	12			2					
			1610092004	计算机组成原理*   Principles of Computer Organization*	2.5	44	32	12				2				
			1618073004	面向对象程序设计   Object-Oriented Programming	3	56	32		24		2					
			1618122004	数据库系统原理   Principle of Database System	2.5	44	32		12		2					
			1610152004	软件工程   Software Engineering	2	32	32					2				
			小计 Subtotal				17.0	296.0	224.0	36.0	36.0	0.0				
	实践 Practice	1610802024	路由和交换网络设计   Design of Routing and Switching Network	2	48		48				4					
		1614312024	操作系统课程设计   Course Design of Operating System	1	24		24				2					
		小计 Subtotal				3	72	0	72	0	0	0	6	0	0	
合计 Total					26.0	466.0	252.0	114.0	36.0	0.0						
专业教育课 Specialized Education	必修 Compulsory	1610782004	网络安全技术   Network Security Technology	2	40	16	24				2					
		1614133004	网络编程技术   Network Programming Technology	3	56	32	24				2					
		1610841004	物联网技术概述   Overview of Internet of Things Technology	1.5	32	8	24					2				

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes	
						讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th		
专业教育课 Specialized Education	必修 Compulsory	1610893004	网络工程技术竞赛   Network Engineering Technology Competition	2	44	8	36				2				
		小计 Subtotal			8.5	172.0	64.0	108.0	0.0	0.0					
	选修 Optional	1632832004	数学竞赛   Mathematics Competition	2	32	32							2		
		1632842004	专业技术竞赛   Professional Technology Competition	2	32	32							2		
		1617553004	电路与电子技术基础   Fundamentals of Circuit and Electronic Technology	2.5	44	32	12			2					
		1634172004	人工智能与大数据分析   Artificial Intelligence and Big Data Analysis	2	36	24	12						2		
		1634192004	移动互联网技术   Mobile Internet Technology	2	36	24	12						2		
		1624143004	高级网络编程技术   Advanced Network Programming Technology	3	56	32	24						2		
		1638002004	Python 语言   Python Language	2	40	16	24			2					
		1650752104	程序设计竞赛 I   Programming Competition I	2.5	48	24	24			2					
		小计 Subtotal			2	324	216	108							
	专业教育选修类课程最少选修 2 学分 At least 2 credits for elective courses														
	实践 Practice	1618011004	网络安全协议分析   Analysis of Network Security Protocol	1.5	36								6		
		1614252024	物联网管理平台规划与实践   Planning and Practice of Internet of Things Management Platform	2	48								8		

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes		
						讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th			
专业教育课 Specialized Education	实践 Practice	1615232034	生产实习   Production Practice	2								+2				
		1617031044	毕业设计（论文）   Graduation Design (Thesis)	14									14			
		小计 Subtotal			19.5	84	0	0	0	0						
		合计 Total			32.0	256.0	64.0	108.0	0.0	0.0						
能力拓展课 Competency Development	必修或实践 Compulsory or Practice	1615254024	专业综合实践   Professional comprehensive practice	4	96		96					12				
		小计 Subtotal			4.0	96.0	0.0	96.0	0.0	0.0						
		本模块为必修实践环节 This module is a required practice														
		总计 Sum			88.0	1080	454	222	36	88	25.5	30.5	17	15		
课外环节 Extracurricular links	课外实践 ar practice	人文社会实践 Culture and Society Practice	1614010014	社会调查   Social Survey	0.5	12				12	0.5				分散	
		身心健康社会实践 Mentally and Physically Practice	0415102013	课外体育锻炼   Extracurricular Physical Exercise	0.5	12				12					分散	
			2640030013	劳动教育实践   Labour Education Practice	0.5	12				12		0.5			分散	
			0510070313	心理健康辅导   Mental Health Counseling	0.5	12				12					分散	
		外语技能实践类 Foreign Language Proficiency Training Practice	0210010013	外语技能实践（初级）   Foreign Language Proficiency Training Practice (elementary)	2.0	48				48				2	(2选1) 分散	

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester				备注 Notes
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	
课外环节 Extracurricular links	课外实践 Extracurricular practice	外语技能实践类 Foreign Language Proficiency Training Practice	0210020013	外语技能实践（高级） Foreign Language Proficiency Training Practice (advanced)	2.0	48				48				2	
		能力与创新实践 Capability and Innovation Practice	1615494014	大学生素质拓展与创新实践 Quality Development and Innovation Practice	4.0	96				96	1~8 学期依据《沈阳化工大学创 新创业实践学分认定办法》由创 新创业学院认定				分散
		成长规划类 Growth Planning Courses	1617601304	职业规划与就业指导 Career Planning and Employment Guidance	1.0	40	40				1				
小计 Subtotal															

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5，课程名称中画\*为考试课。

Note: "Cre. (Credits)", "T.C.H. (Total Credit Hours)", "Lec. (Lecture)", "Exp. (Experiment)", "Pro. (Programming)", "Pra. (Practice)".

## 十、网络工程专业学士学位课程一览表

### A list of bachelor's degree programs in Network Engineering

课程类别 Course Type	模块名称 Modules	序号 No.	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester	
通识教育课 General Education	思政类 Ideological and Political Courses	1	0710043003	马克思主义基本原理 Elementary Theory of Marxism	3	2	
学科平台课 Discipline Education	数学与自然 科学类 Natural Science & Mathematics	3	0310002103	高等数学 I*   Advanced Mathematics I*	2.0	1	
		4	0310002203	高等数学 II*   Advanced Mathematics II*	2.0	2	
		5	1618082004	算法与数据结构**   Algorithm and Data Structure*	2.5	1	
	专业基础 Subject Foundation Requisite	6	1610132004	操作系统*   Operating System*	2	2	
		7	1610142004	计算机网络*   Computer Network*	2.5	1	
		8	1610092004	计算机组成原理*   Principles of Computer Organization*	2.5	2	
		9	1618073004	面向对象程序设计   Object-Oriented Programming	3	1	
		10	1618122004	数据库系统原理   Principle of Database System	2.5	1	
		11	1610152004	软件工程   Software Engineering	2	2	
	专业教育课 Specialized Education	必修 Compulsory	12	1610782004	网络安全技术   Network Security Technology	2	2
			13	1614133004	网络编程技术   Network Programming Technology	3	2
14			1610841004	物联网技术概述   Overview of Internet of Things Technology	1.5	3	

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》

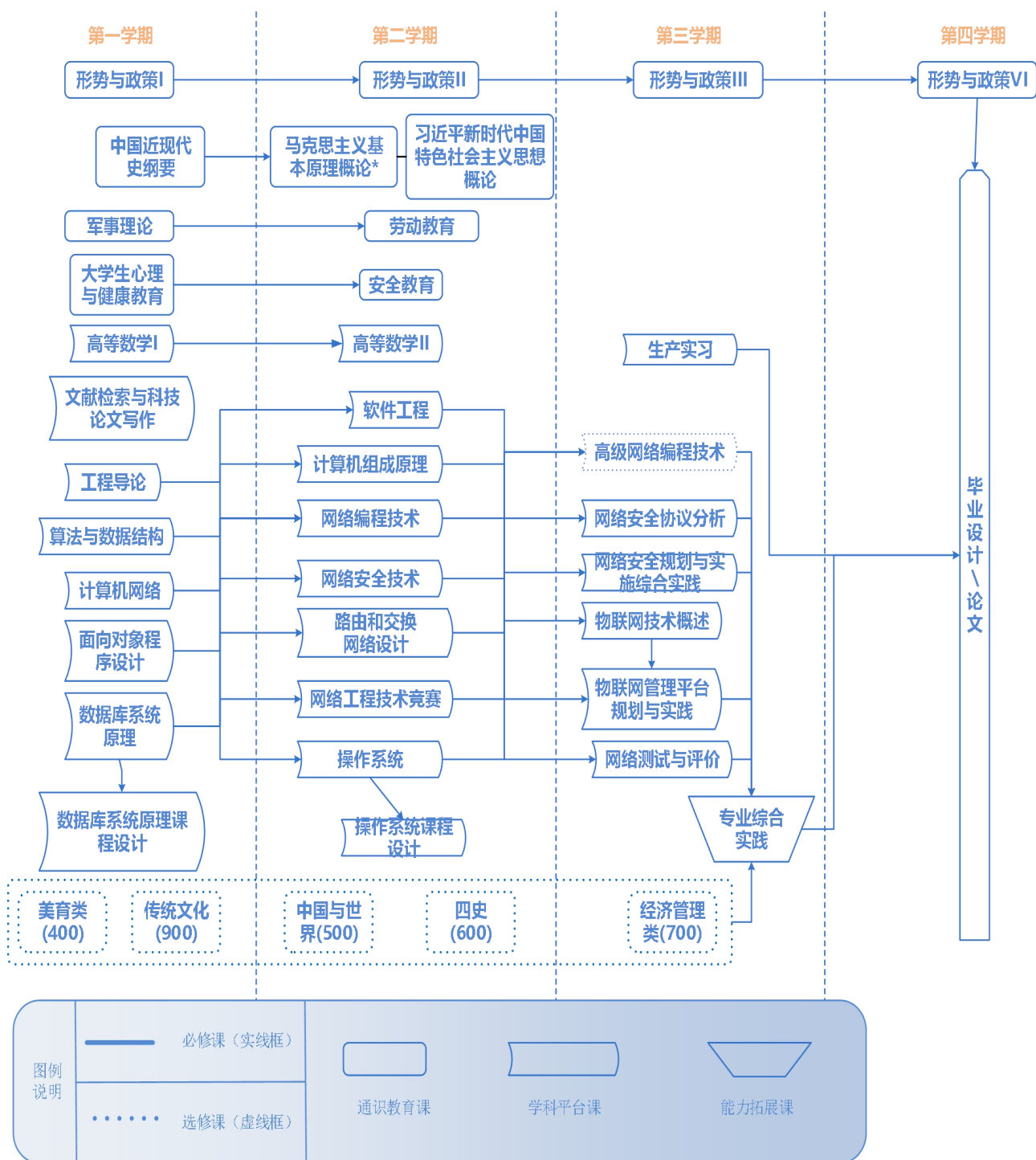
### 十一、全学程实践环节周历安排 Weekly Calendar of all Practice Sessions

学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注
一		☆	☆															::	::	·		
二																		::	::	·		
三							/	/	P	P	P	P	P	P	P	P		::	::	·		
四	=	=	=	=	=	=	=	=	=	=	=	=	=	=				::	::	·		

符号说明(Symbol Description):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P 各类实训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼ 认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计(论文)||Graduation Project(Thesis)    ·小学期||Primary Term

## 十二、课程体系配置图 Curriculum System Configuration Diagram





十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements ( High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	11.1	11.2	12.1	12.2	
中国近现代史纲要   Outline of Chinese Contemporary and Modern History																						H											
习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																						H	M	H									
马克思主义基本原理*   Basic Principles of Marxism*																						H	M	H									
形势与政策   Current Situation and Policies																				H	H	H	H										
大学外语I   College English I																														H			L
大学外语II   College English II																													H				L
军事理论   Military Theory																	M		M														
安全教育   Safety Education																	H																
劳动教育   Labour Education																							H										



课程 (Courses)	毕业能力要求 (Graduation Requirements)																																	
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	11.1	11.2	12.1	12.2		
网络安全技术   Network Security Technology			H				H										M	M						H										
网络编程技术   Network Programming Technology			H						H			H																						
物联网技术概述   Overview of Internet of Things Technology										M			M																					
网络工程技术竞赛   Network Engineering Technology Competition									H	H	H														M	M			H					
路由和交换网络设计   Design of Routing and Switching Network								H	H	H	H																							
操作系统课程设计   Course Design of Operating System												H	H																					
网络安全协议分析   Analysis of Network Security Protocol															H	H	H	H	H															
物联网管理平台规划与实践   Planning and Practice of Internet of Things Management Platform																									H	H							H	H
毕业设计 (论文)   Graduation Design (Thesis)							H				H																	H	H		H	H		
专业综合实践   Professional Comprehensive Practice															H	H	H														H	H		H



# 制药与生物工程学院



# 沈阳化工大学本科培养方案

## 制药与生物工程学院

专业名称：制药工程

专业代码：081302

制 定：宋艳玲

审 核：张 卉

审 定：于三三

批 准：金志浩

2021年8月

# 制药工程专业培养方案

## 一、培养目标

本专业面向现代制药行业及其相关领域经济建设发展的需求，培养德智体美劳全面发展，具有良好的人文社会科学素养和社会责任感，具备相关自然科学、药学、工程技术科学基本知识及制药工程专业知识，能够在制药及相关领域的生产企业、科研院所和管理部门等单位从事产品与技术开发、工艺与工程设计、质量管理与控制、生产与经营管理等工作应用型工程技术人才，成为自觉服务国家的社会主义事业合格建设者和可靠接班人。

本专业学生在毕业 5 年左右达到以下预测目标：

(1) 能够运用制药工程科学原理和工程设计基本理论，分析和解决制药过程中的复杂工程问题，以提升药品质量，提高生产效率和经济效益；

(2) 能够秉持社会可持续发展理念，并遵循经济、环境、法律、安全和行业规范等要求，创造性地运用所学知识，推动技术研究、开发及项目管理等工作的有效开展；

(3) 能够在制药工程实践中理解并遵守工程职业道德规范，具有国际视野和较强的沟通、团队合作能力；

(4) 能够通过继续教育或其它学习渠道更新知识，实现能力和技术水平的提升，自觉服务社会。

## 二、专业方向

化学制药

## 三、毕业要求

本专业基于 OBE 人才培养教育理念，毕业要求完全覆盖工程教育专业认证标准所规定的 12 条内容，毕业生应获得工程知识、问题分析、设计/开发解决方案、研究、使用现代工具、工程与社会、环境和可持续发展、个人和团队、沟通、项目管理和终身学习方面的知识和能力，具体详见下表。

毕业能力要求及其指标点分解：

毕业能力要求	指标点
毕业要求 1： 能够将数学、自然科学、工程科学和制药工程专业相关知识应用于解决制药过程中的复杂工程问题。	1-1.掌握能够用于合理描述制药过程中复杂工程问题的数学、自然科学、工程基础和专业知识。
	1-2.能够针对制药过程中的复杂工程问题建立数学模型并求解。
	1-3.能够将相关知识和数学模型方法用于推演、分析制药过程中的工程应用问题。
	1-4.能够将制药工程专业知识和数学建模用于分析和解决制药过程中的复杂工程问题。
毕业要求 2： 能够应用数学、自然科学、工程科学和制药工程的基本原理，识别、表达、并通过文献研究分析制药过程中的复杂工程问题，得出有效结论。	2-1.能够运用数学、自然科学、工程科学和制药工程的基本原理，对制药过程中的复杂工程问题的关键环节进行识别和判断。
	2-2.能够基于相关科学原理和数学模型方法正确表达制药过程中的复杂工程问题。
	2-3.能够运用相关科学原理，结合文献研究，分析制药过程中的复杂工程问题，获得有效结论。



<p>毕业要求 3:</p> <p>能够设计针对制药过程中的复杂工程问题的解决方案,设计满足特定需求的系统、单元或工艺流程,并能够在设计或开发过程中体现创新意识,考虑社会、健康、安全、法律、文化以及环境等因素。</p>	3-1.掌握制药过程工艺设计和产品开发全周期、全流程的基本设计/开发的方法及技术,了解影响设计目标和技术方案的各种因素。
	3-2.能够针对制药过程的特定需求完成单元设计。
	3-3.能够针对复杂制药工程问题进行系统或工艺流程设计,并体现创新意识,并能综合考虑社会、健康、安全、法律、文化及环境等因素。
<p>毕业要求 4:</p> <p>能够基于科学原理并采用科学方法对制药过程中的复杂工程问题进行研究,包括实验设计、数据分析和信息综合,以获得有效结论。</p>	4-1.能够基于科学原理,调研和分析制药过程中复杂工程问题的解决方案。
	4-2.能够根据制药过程中复杂工程问题的特征,选择合理的研究方法,设计科学的实验方案。
	4-3.能够根据实验方案,开展实验,正确采集实验数据,对实验结果进行分析和解释,得出合理有效的结论。
<p>毕业要求 5:</p> <p>能够针对复杂制药工程及相关领域问题,开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具,模拟与预测制药过程的工程问题,并能够理解其局限性。</p>	5-1.了解制药工程专业常用的现代仪器、信息技术工具、工程工具和模拟软件的使用原理和方法,并理解其局限性。
	5-2.能够选择和使用现代仪器、CAD、专业数据库及模拟软件等,对药品制备与加工过程中的复杂工程问题进行分析和计算。
	5-3.能够开发或选用恰当的专业软件,模拟和预测制药过程中的工程问题,并能够领会相关工具的局限性。
<p>毕业要求 6:</p> <p>能够基于制药工程专业相关领域的标准、法律和法规等背景知识进行合理分析,评价制药工程实践和复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响,并理解应承担的责任。</p>	6-1.具有制药行业实习和社会实践的经历。
	6-2.熟悉与制药行业相关的技术标准、知识产权、产业政策和法律法规,了解制药企业管理体系。
	6-3.能够识别和评价复杂制药工程问题的解决方案对社会、健康、安全、法律以及文化的影响,并理解应承担的责任。
<p>毕业要求 7:</p> <p>能够理解和评价针对制药过程中复杂工程问题的工程实践对环境、社会可持续发展的影响。</p>	7-1.熟悉国家对制药工程领域的环境保护和可持续发展的方针、政策和法规。
	7-2.能够认识到药品生产和使用等环节对环境和社会经济可持续发展的影响。
<p>毕业要求 8:</p> <p>具有良好的人文社会科学素养、社会责任感,能够在制药工程实践中理解并遵守工程职业道德和规范,履行责任。</p>	8-1.具有良好的道德品质和人文社会科学素养,树立和践行社会主义核心价值观,理解个人与社会的关系,了解中国国情,明确个人作为社会主义事业建设者和接班人所肩负的责任和使命。
	8-2.理解诚实公正、诚信守则的工程职业道德和规范,并能在制药工程实践中自觉遵守。
	8-3.理解制药工程师对公众的安全、健康和福祉,以及环境保护的社会责任,能够在工程实践中自觉履行责任。
<p>毕业要求 9:</p> <p>具有组织管理能力和团队意识,能够在多学科背景团队中承担个体、团队成员以及负责人的角色。</p>	9-1.理解制药工程问题的多学科技术背景和特点,在团队合作中进行有效沟通与协作,能够在团队活动中明确个人职责和角色。
	9-2.具有组织和协助管理的经历,能够与他人共同合作协商,进行合理决策。
<p>毕业要求 10:</p> <p>能够就制药过程中的复杂工程问题与业界同行及社会公众进行有效沟通和交流,具有撰写报告和设计文稿、陈述发言、清晰表达或回应指令的能力。具备一定的国际视野,能够在跨文化背景下进行沟通和交流。</p>	10-1.能够通过撰写报告、设计文稿图表和陈述发言等清晰地表达制药复杂工程问题的解决方案,并能够理解业界同行及社会公众的质疑和建议。
	10-2.了解制药工程专业领域的国际发展趋势、研究热点,理解不同文化和发展水平之间的差异性和多样性。具有跨文化交流的语言和书面表达能力,能就制药工程专业问题,在跨文化背景下进行基本沟通和交流。

毕业要求 11: 理解并掌握工程管理原理与经济决策方法, 并能将与制药工程相关的多学科环境中应用。	11-1.掌握制药工程项目中的管理原理与经济决策方法, 能够对制药过程和产品等进行过分析和比较。
	11-2.能够将工程管理原理和决策方法应用于制药工程相关的多学科实践活动中。
毕业要求 12: 具有自主学习和终身学习的意识, 能不断学习并及时了解制药工业的发展动态, 具有适应行业发展的能力。	12-1.能够在社会发展的大背景下了解制药工程行业发展的新趋势, 认识到自主和终身学习的必要性。
	12-2.具有良好的自主学习能力, 包括对技术资料进行分析、归纳, 总结以及提出问题的能力, 能够适应科技进步对职业能力的新的要求。

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。

### 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标			
	培养目标 1	培养目标 2	培养目标 3	培养目标 4
1: 工程知识	√			
2: 问题分析	√	√		
3: 设计/开发解决方案	√	√		
4: 研究	√	√		
5: 使用现代工具	√	√		
6: 工程与社会		√		√
7: 环境和可持续发展		√		
8: 职业规范			√	√
9: 个人和团队			√	
10: 沟通			√	
11: 项目管理		√		
12: 终身学习	√	√	√	√

#### 四、主干学科

化学工程与技术、药学

#### 五、专业核心课程

有机化学、物理化学、生物化学、药物化学、药剂学、药物分析、化工原理、化学制药工艺学、药品生产质量管理工程、制药安全与环保、制药设备与车间设计

#### 六、修业年限

学制: 4 年; 学生可在 3-6 年内修完本专业规定学分。

#### 七、授予学位

学生应至少修满 171 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者, 可授予工学学士学位。

## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例(%)
通识教育课	通识教育必修课	思政类	必修	18	41	24.0
		外语类		12		
		计算机类		2		
		军事安全类		2		
		劳动体育类		5		
		创新创业类		2		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	2	8	4.7
		中国与世界(500)		1		
		四史(600)		1		
		经济管理类(700)		1		
		科学技术类(800)		1		
		传统文化(900)		2		
通识教育实践课	军训	实践	2	2	1.2	
学科平台课	学科基础课程	公共基础类	必修	73	73	70.1
		专业基础类				
	学科实践课程	-	实践			
专业教育课	专业核心课程	-	必修	16.5	41.5	
	专业选修课程	-	选修	≥4		
	专业实践课程	-	实践	21		
能力拓展课	专业特色课程	-	实践	5.5	5.5	
课外环节	课外通识实践	人文社会实践	课外实践	4		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
	生涯教育	成长规划类		1		
总学分/比例					171	100%



# Pharmaceutical Engineering Major 2021 Undergraduate Education Program

## I. Educational Objectives

### 1. Educational Objectives

Facing the needs of economic construction and development in modern pharmaceutical industry and related fields, the major cultivates applied talents in engineering and technology who are well-rounded development of moral, intellectual, physical, aesthetic and labor, along with good humanistic cultivation and social responsibility. They possess basic knowledge of natural science, engineering technology science and pharmaceutical engineering, so they can engage in design, production, management, new product development and new technology research in manufacturing enterprises, research institutes and management departments of pharmaceutical engineering and related fields. They will become qualified builders and reliable successors of the socialist cause serving the country consciously.

Graduates should obtain knowledge and competences as follows:

(1) To be able to apply the scientific principles of pharmaceutical engineering and basic theories of engineering design to analyze and solve problems in the process of pharmaceutical manufacturing and processing in order to improve product quality, production efficiency and economic benefits.

(2) The ability to creatively apply knowledge learned to promote effective development of technical research, product development and project management in a socially sustainable manner and in compliance with economic, environmental, legal, safety and industry norms, adhering to the concept of social sustainable development.

(3) Ability to understand and comply with the code of ethics for the engineering profession in pharmaceutical engineering practice, with an international perspective and strong communication and teamwork skills.

(4) Ability to update knowledge through continuing education or other learning channels to achieve an increased level of competence and skills and to serve the society consciously.

## II. Major direction

Chemical Pharmaceutical

## III. Graduation Requirements

The pharmaceutical engineering major is based on the OBE talent training and education concept, and the graduation requirements fully cover the 12 items specified in the certification standard of engineering education major. Graduates should obtain engineering knowledge, problem analysis, design/development solutions, research, use modern tools, engineering and society, environment and sustainable development, individual and team, communication, management and management knowledge and ability in project management and lifelong

learning.

Graduates should obtain knowledge and competences as follows:

Graduation Requirements	Indices
<p>Requirement 1: Be able to apply relevant knowledge of mathematics, natural science, engineering science and pharmaceutical engineering to solve complex engineering problems in the process of drug manufacturing and processing.</p>	1-1. Be able to apply mathematics, natural science, engineering foundation and pharmaceutical engineering professional knowledge to properly describe complex engineering problems in the process of drug manufacturing and processing.
	1-2. Be able to establish and solve mathematical models for the complex engineering problems in the process of drug manufacturing and processing.
	1-3. Be able to use relevant knowledge and mathematical model methods to deduce and analyze engineering application problems in the process of drug manufacturing and processing.
	1-4. Be able to use pharmaceutical engineering expertise and mathematical modeling to analyze and solve complex engineering problems in the process of drug manufacturing and processing.
<p>Requirement 2: Have the ability to apply the basic principles of mathematics, natural sciences, engineering sciences, pharmaceutical engineering sciences to identify, express, and analyze complex engineering problems in the process of drug manufacturing and processing through literature research, and get valid conclusions.</p>	2-1. Be able to use the basic principles of mathematics, natural science, engineering science and pharmaceutical engineering to identify and judge the key links of complex engineering problems in the process of pharmaceutical manufacturing and processing.
	2-2. Be able to correctly express the complex problems of pharmaceutical engineering in the process of drug manufacturing and processing based on relevant scientific principles and mathematical model methods.
	2-3. Be able to use relevant scientific principles and literature research to analyze complex engineering problems in the process of drug manufacturing and processing, and obtain effective conclusions.
<p>Requirement 3: Have the ability to comprehensively use the theoretical knowledge mastered to design solutions to complex engineering problems in the process of drug manufacturing and processing. Able to design systems, units or processes that meet specific needs, reflect the sense of innovation in the design process, and consider social, health, safety, legal, cultural and environmental factors in the design or development process.</p>	3-1. Master the basic design / development methods and technologies of the whole cycle and whole process of drug manufacturing and processing process, understand the various factors that affect the design goals and technical solutions.
	3-2. Be able to design systems or technological process for the specific needs of pharmaceutical manufacturing and processing.
	3-3. Be able to carry out system or process design for complex pharmaceutical engineering problems, reflect the sense of innovation, and comprehensively consider social, health, safety, legal, cultural and environmental factors
<p>Requirement 4: Be able to study complex engineering problems in the process of drug manufacturing and processing based on scientific principles and scientific methods, including experimental design, data analysis and information synthesis, so as to obtain effective conclusions.</p>	4-1. Be able to investigate and analyze solutions to complex engineering problems in pharmaceutical process based on scientific principles.
	4-2. Be able to select reasonable research methods and design scientific experimental schemes according to the characteristics of complex engineering problems in the pharmaceutical process.
	4-3. Be able to carry out experiments according to the experimental scheme, correctly collect experimental data, analyze and explain the experimental results, and draw reasonable and effective conclusions.

<p>Requirement 5: Have the ability to develop, select and use appropriate techniques, resources, modern engineering tools and information technology tools for complex engineering and related field problems, simulate and predict professional problems in the process of drug manufacturing and processing.</p>	5-1.Be able to understand the principles and methods of using modern instruments, information technology tools, engineering tools and simulation software commonly used in pharmaceutical engineering majors, and understand their limitations.
	5-2. Be able to select and apply modern instruments, CAD, professional database and simulation software to analyze and calculate complex engineering problems in the process of drug manufacturing and processing.
	5-3.Be able to develop, select and use appropriate modern analysis tools or software to simulate and predict professional problems in the process of drug manufacturing and processing, and be able to analyze their limitations.
<p>Requirement 6: Based on the standards, laws and regulations in the pharmaceutical engineering, be able to properly analyze and evaluate the impact of the solutions to pharmaceutical engineering practice and complex engineering problems on society, health, safety, law and culture. Have a good understanding of the responsibilities to be undertaken.</p>	6-1.Have the experience of internship and social practice in pharmaceutical industry.
	6-2. Be familiar with the technical standards, intellectual property rights, industrial policies, laws and regulations related to the pharmaceutical industry. Have a good understanding of the management system of pharmaceutical enterprises.
	6-3. Be able to identify and evaluate the impact of the solutions to complex pharmaceutical engineering problems on society, health, safety, law and culture. Have a good understanding of the responsibilities to be undertaken.
<p>Requirement 7: Be able to understand and evaluate the impact of engineering practice aiming at complex engineering problems in the process of pharmaceutical manufacturing and processing on environmental and social sustainable development.</p>	7-1.Be familiar with national guidelines, policies and regulations on environmental protection and sustainable development of pharmaceutical process.
	7-2. Be able to realize the impact of drug production and application on the environmental, social and economic sustainable development.
<p>Requirement 8: Have good humanities and social sciences, a sense of social responsibility, compliance with the law, integrity, and the ability to understand and comply with the code of ethics for the engineering profession and fulfil responsibilities in the practice of pharmaceutical engineering .</p>	8-1.Possess good moral qualities and humanities and social science literacy, establish and practise socialist core values, understand the relationship between the individual and society, understand China's national conditions, and clarify the responsibilities and missions of individuals as builders and successors of the socialist cause.
	8-2. Have a good understanding of the engineering professional ethics and the codes of honesty, justice and integrity. Be able to consciously abide by them in the practice of pharmaceutical engineering.
	8-3.Have a good understand of the social responsibility of pharmaceutical engineers for the safety, health and well-being of the public, as well as environmental protection. Be able to consciously fulfill their responsibilities in engineering practice.
<p>Requirement 9: Have organization and management abilities and team spirits.Be able to assume the role of individual, team member and person in charge in the multidisciplinary team related to</p>	9-1.Have a good understanding of the multi-disciplinary technical background and characteristics of pharmaceutical engineering problems. Be able to conduct effective communication and cooperation in team cooperation. Be able to clarify personal responsibilities and roles in team activities.
	9-2. Have the experience of organizing and assisting in management. Be able to cooperate and negotiate with others to make reasonable decisions.

pharmaceutical engineering.	
Requirement 10: Be able to effectively communicate with peers and the public on complex engineering issues of pharmaceutical process and product quality. Be able to write reports and design manuscripts, make statements, clearly express or respond to instructions. And have a certain international vision and communication ability in the cross-cultural background.	10-1.Be able to clearly express solutions to complex pharmaceutical engineering problems by writing reports, designing manuscripts, charts and statements, and understand the doubts and suggestions of industry peers and the public.  10-2.Understand the international development trends and research hotspots in the field of pharmaceutical engineering, and understand the differences and diversity between different cultures and development levels. Have the language and written expression ability of cross-cultural communication, and be able to conduct basic communication and exchange on pharmaceutical engineering professional issues in a cross-cultural context.
Requirement 11: Understand and master engineering management principles and economic decision-making methods, and be able to apply them in multidisciplinary environment related to pharmaceutical engineering.	11-1.Master the management principles and economic decision-making methods in pharmaceutical engineering projects, and be able to analyze and compare the pharmaceutical processes and products.  11-2. Be able to apply engineering management principles and decision-making methods to the multidisciplinary practice activities related to pharmaceutical engineering.
Requirement 12: Have the awareness of self-learning and lifelong learning. Be able to constantly study and understand the development of the pharmaceutical industry timely.Have the ability to adapt to the development of the industry.	12-1.Be able to understand the development trend of the pharmaceutical industry and realize the necessity of self learning and lifelong learning.  12-2. Have good self-learning ability, including the ability to analyze, summarize, summarize and ask questions about technical data, and be able to adapt to the new requirements of scientific and technological progress on professional ability.

### The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives			
	Educational Objectives 1	Educational Objectives 2	Educational Objectives 3	Educational Objectives 4
1: Engineering Knowledge	√			
2: Problem Analysis	√	√		
3: Design/Development Solutions	√	√		
4: Research	√	√		
5: Use of Modern Tools	√	√		
6: Engineering and Society		√		√
7: Environment and Sustainable Development		√		
8: Professional Norms			√	√
9: Individuals and Teams			√	
10: Communicate			√	
11: Project Management		√		
12: Lifelong Learning	√	√	√	√



#### **IV. Major Subject**

Chemical Engineering and Technology, Pharmacy

#### **V. Core Courses**

Organic Chemistry, Physical Chemistry, Biochemistry, Pharmaceutical Chemistry, Pharmaceutics, Pharmaceutical Analysis, Chemical Principles, Chemical Pharmaceutical Technology, Quality Management Engineering of Pharmaceutical Production, Pharmaceutical Safety and Environmental Protection, Pharmaceutical Equipment and Workshop Process Design

#### **VI. Educational System**

Length of Schooling: 4 years; Students should obtain the required credits of this major within 3-6 years.

#### **VII. Confer Degrees**

Students are required to obtain at least 171 credits before graduation. The Bachelor of Engineering Degree can be granted to those who meet the requirements of the Relevant Regulations on the Awarding of Bachelor's Degree for Graduates of Shenyang University of Chemical Technology (revised in March 2017).

## VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit requirement	Subtotal	Proportion (%)
General Education	General Education (Compulsory)	Ideological and Political Courses	Compulsory	18	41	24.0
		Foreign Language Courses		12		
		Computer Courses		2		
		Military and Safety Courses		2		
		Labor and Sport Education		5		
		Innovation and Entrepreneurship		2		
		Mental Health		1		
	General Education (Optional)	Aesthetic Education(400)	Optional	2	≧ 8	4.7
		China and the World(500)		1		
		Four Histories(600)		1		
		Economic Management(700)		1		
		Science and Technology(800)		1		
		Traditional Culture(900)		2		
Discipline Education	Basic Courses	Public basic class	Compulsory	73	73	
		Professional foundation				
	Basic Practice Sessions	-	Practice			
Specialized Education	Core Courses	-	Compulsory	16.5	41.5	1.2
	Optional Courses	-	Optional	≧ 4		
	Specialized Practice Sessions	-	Practice	21		
Competency Development	Individualized Courses	-	Practice	5.5	5.5	
		-	Compulsory	0	0	
Extracurricular links	Extracurricular General Education Practice	Culture and Society Practice	Extracurricular Practice	4		70.1
		Mentally and Physically Practice				
		Foreign Language Proficiency Training Practice				
	Extracurricular Characteristic Practice	Innovative Training		4		
		Innovation Competition				
		Chuangke Activities				
	Career Education	Growth Planning Courses		1		
Total/Proportion					171	100%

## 九、制药工程专业教学进程表

### Table of Teaching Schedule for Pharmaceutical Engineering Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
通识教育课 General Education	必修 Compulsory	思政类 Ideological and Political Courses	0710093001	思想道德与法治    Ideological Morality and the Rule of Law	3.0	48	32			16	2									
			0710053001	中国近现代史纲要   Outline of Chinese Contemporary and Modern History	3.0	48	32			16		2								
			0710103001	马克思主义基本原理*   Elementary Theory of Marxism*	3.0	48	32			16			2							
			0710123001	习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8					3					
			0710133001	毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3.0	48	32			16				2						
			0710012301	形势与政策   Current Situation and Policies	2.0	64	64					2	2	2	2	2	2	2	2	
				0211003101	大学外语I   College English I	3.0	48	48				3								
				0211003201	大学外语II   College English II	3.0	48	48					3							
				0241003301	大学外语III   College English III	3.0	48	48						3						五选一

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th			
通识教育课 General Education	必修 Compulsory	外语类 Foreign Language Courses	0241003301	大学外语III（进阶英语）    College English III（Advanced English CET 6-Orientated）	3.0	48	48						3						五选一		
				大学外语III（英语口语表达与交流）    College English III（English Oral Expression and Communication）	3.0	48	48					3									
				大学外语III（跨文化交际）    College English III（Intercultural Communication）	3.0	48	48					3									
				大学外语III（英语写作表达与交流）    College English III（English Writing Expression and Communication）	3.0	48	48					3									
			0241003401	大学外语IV*   College English IV*	3.0	48	48								3						
				大学外语IV（进阶英语）    College EnglishIV（Advanced English CET 6-Orientated）	3.0	48	48								3						
				大学外语IV（英语口语表达与交流）    College EnglishIV（English Oral Expression and Communication）	3.0	48	48								3						
				大学外语IV（跨文化交际）    College English IV（Intercultural Communication）	3.0	48	48								3						
		0241003401	大学外语IV（英语写作表达与交流）    College English IV（English Writing Expression and Communication）	3.0	48	48								3							
			计算机类 Computer Courses	1613242001	大学计算机基础   Fundamentals of Computer	2.0	36	24			12		2								
		军事安全类 Military and Safety Courses	0710081001	军事理论   Military Theory	1.0	16	16					2									



课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th			
学科平台课 Discipline Education	必修 Compulsory	数学与自然科学类 Natural Science & Mathematics	0310004101	高等数学 I*   Advanced Mathematics I*	4.5	80	72			8	6										
			0310005201	高等数学 II*   Advanced Mathematics II*	5.5	96	88			8	6										
			0310032001	线性代数    Linear Algebra	2.0	32	32							2							
			0310042001	概率论与数理统计   Probability and Statistics	2.0	32	32								2						
			0310063101	大学物理 I*   University Physics I*	3.0	48	46	2					3								
			0310063201	大学物理 II*   University Physics II*	3.0	48	46	2						3							
			0319022001	无机化学 B*   Inorganic Chemistry B*	2.0	32	32					3									
			0319063001	分析化学 C*   Analytical Chemistry C*	3.5	56	56							4							
			1910022002	生物化学*   Biochemistry*	2.0	32	32								2						
		工程基础类 Foundation Engineering	2118004001	工程制图及 CAD*   Engineering Drawing & CAD*	4.0	68	56		12					4							
			1510122001	电工学*   Electrical Engineering*	2.5	44	32	12						3							
			1910011002	工程导论   Introduction to Engineering	1.0	16	16					2									CDIO 课程
				0319092101	有机化学 AI*   Organic Chemistry AI*	2.5	40	40						3							

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes			
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th				
学科平台课 Discipline Education	必修 Compulsory	专业基础类 Subject Foundation Requisite	0319092201	有机化学 AII*   Organic Chemistry AII*	2.5	40	40							3								
			0319133101	物理化学 AI*   Physical Chemistry AI*	3.0	48	48							3								
			0319132201	物理化学 AII*   Physical Chemistry AII*	2.0	32	32									2						
			1110013101	化工原理 I*   Unit Operations of Chemical Engineering I*	3.0	48	48									3						
			1110013201	化工原理 II*   Unit Operations of Chemical Engineering II*	3.0	48	48											3				
			1910051002	人体解剖生理学   Human Anatomy and Physiology	1.0	16	16										2					
			1910042002	药理学*   Pharmacology*	2.0	32	32											2				
			1910032002	药物合成反应*   Drug Synthetic Reaction*	2.0	32	32										2					
			1910061002	制药工程专业外语   Special English of Pharmaceutical Engineering	1.0	16	16										2					
			1910071002	外科技论文写作与文献检索   English Research Paper Writing and Literature Retrieval	1.0	16	16													2		
				小计 Subtotal	58.0	952	908	16	12	16	128	144	288	152	144	80	16					
		实践 Practice		0310081111	大学物理实验 I    University Physics Experiment I	1.0	24	6	18			3										
			0310081211	大学物理实验 II    University Physics Experiment II	1.0	24		24					4									
	0311061111		无机化学实验 I	1.0	24		24			4												

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八			
										1st	2nd	3rd	4th	5th	6th	7th	8th			
学科平台课 Discipline Education	实践 Practice		Inorganic Chemistry Experiment I																	
		0311071211	无机化学实验 II    Inorganic Chemistry Experiment II	1.0	24		24				4									
		0313191011	分析化学实验 A    Analytical Chemistry Experiment A	1.5	36	4	32					4								
		0312081011	有机化学实验 A    Organic Chemistry Experiment A	1.5	36		36						6							
		0319232011	物理化学实验 B    Physical Chemistry Experiment B	2.0	48	4	44							4						
		2110072031	金工实习    Metalworking Practice	2.0	48		48				+2									
		1110032021	化工原理课程设计    Course Design of Unit Operations of Chemical Engineering	2.0	48	48										+2				
		1110041111	化工原理实验 I    Unit Operations of Chemical Engineering Experiment I	1.0	24		24								+1					
		1110041211	化工原理实验 II    Unit Operations of Chemical Engineering Experiment II	1.0	24		24									+1				
		小计 Subtotal				15.0	360	62	298			24	96	60	36	72	72			
合计 Total				73.0	1312	970	314	12	16	152	240	348	188	216	152	16				
	必修 Compulsory	1910083002	药物化学*    Medicinal Chemistry*	3.0	48	48										4				
		1910132002	药剂学*    Pharmacy*	2.0	32	32									2					
		1910142002	药物分析*	2.0	32	32									2					





课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th	
(专业教育课选修课程学分要求≥4 学分; The credit requirement of the optional specialized education courses shall be ≥ 4 credits)																			
专业教育课 Specialized Education	实践 Practice		1910232032	认识实习   Cognition practice	2.0	+2									+2				
			1910242032	生产实习   Produce Practice	2.0	+2											+2		
			1910253012	药物合成反应实验   Drug Synthesis Reaction Experiment	3.0	72											+3		
			1910261042	毕业设计(论文)   Graduation Design (Thesis)	14.0	+14													+14
			小计 Subtotal				21.0												
合计 Total					40.5														
能力拓展课 Competency Development	必修或实践 Compulsory or Practice		1910271022	制药设备与车间课程设计   Course Design of Pharmaceutical Equipment and Workshop	1.5	36										+1.5			
			1910284012	制药工程专业实验   Speciality Experimental of Pharmaceutical Engineering	4.0	96											+4	CDIO 课程	
			小计 Subtotal			5.5	132											132	
			(必须修读所有能力拓展课程) (All the Competency Development Courses are required to be taken.)																
总计 Sum					171.0	2332	1762	458	24	88	336	404	480	336	264	320	128	64	
课外 环节 Extracurricular links	课外实践 Extracurricular practice	人文社会实践 Culture and Society Practice	1910501012	社会调查   Social Survey	0.5	12											0.5		
		成长规划类 Growth Planning	1910561012	职业规划与就业指导   Career Planning and Employment Guidance	1.0	40					40	1					1		

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th		
课外 环节 Extracurricular links	课外实践 Extracurricular practice	Courses																		
		身心健康社会实践 Mentally and Physically Practice	0410050751	课外体育锻炼   Extracurricular Physical Exercise	0.5	12												0.5		
			2640030011	劳动教育实践   Labour Education Practice	0.5	12						0.5								
			0510070311	心理健康辅导   Mental Health Counseling	0.5	12												0.5		
		外语技能实践类 Foreign Language Proficiency Training Practice	0210010011	外语技能实践（初级）   Foreign Language Proficiency Training Practice (Elementary)	2.0	48									2					二选一
			0210020011	外语技能实践（高级）   Foreign Language Proficiency Training Practice (Advanced)	2.0	48									2					
		能力与创新实践 Capability and Innovation Practice	1910604312	大学生素质拓展与创新实践   Quality Development and Innovation Practice	4.0	96												1~8 学期依据《沈阳化工大学创新创业实践学分认定办法》由创新创业学院认定 1~8 Semesters are recognized by the College of Innovation and Entrepreneurship according to the Measures for Recognition of Innovation and Entrepreneurship Practice Credits of Shenyang University of Chemical Technology		
小计 Subtotal																				

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5,课程名称中画\*为考试课。

1 credit and 16 credit hours for theory course; 1 credit and 24 credit hours for experimentand computer course; 1 credit and 36 credit hours for physical education course; 1 credit and 1 teaching week for concentrated practice; the minimum unit of credit is 0.5, and \* marked in the courseis the exam course.

Note: “Cre. (Credits)”, “T.C.H. (Total Credit Hours)”, “Lec. (Lecture)”, “Exp. (Experiment)”, “Pro. (Programming)”, “Pra. (Practice)”.

## 十、制药工程专业学士学位课程一览表

### A List of Bachelor's Degree Programs in Pharmaceutical Engineering

课程类别 Course Type	模块名称 Modules	序号 No.	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester	
通识教育课 General Education	政治理论 Political Theory	1	0710103001	马克思主义基本原理* Elementary Theory of Marxism*	3.0	4	
		2	0710133001	毛泽东思想和中国特色社会主义理论体系概论 I* Mao Zedong Thought and Theory of Socialism with Chinese Characteristics I*	3.0	4	
学科平台课 Discipline Education	数学与自然科学类 Natural Science & Mathematics	3	0310014101	高等数学I* Advanced Mathematics I*	4.5	1	
		4	0310063101	大学物理I* University Physics I*	3.0	2	
		5	1910022002	生物化学* Biochemistry*	2.0	4	
	工程基础类 Foundation Engineering	6	2118004001	工程制图及 CAD* Engineering Drawing & CAD*	4.0	3	
		7	1510122001	电工学* Electrical Engineering*	2.5	3	
	专业基础 Subject Foundation Requisite	8	0319092101	有机化学 AI*   Organic Chemistry AI*	2.5	3	
		9	0319133101	物理化学 AI*   Physical Chemistry AI*	3.0	4	
		10	1110013101	化工原理 I* Principles of Chemical Engineering I*	3.0	4	
		11	1910042002	药理学* Pharmacology*	2.0	6	
		12	1910032002	药物合成反应* Drug Synthetic Reaction*	2.0	5	
	专业教育课 Specialized Education	专业课 Specialized Course	13	1910083002	药物化学* Medicinal Chemistry*	3.0	7
			14	1910132002	药剂学* Pharmacy*	2.0	6
15			1910142002	药物分析* Pharmaceutical Analysis *	2.0	6	
16			1910152002	制药分离工程* Separation Engineering of Pharmaceutical*	2.0	6	
17			1910102002	化学制药工艺学* Chemical Pharmaceutical Technology*	2.0	6	
18			1910112002	制药设备与车间设计* Pharmaceutical Equipment and Workshop Design*	2.5	7	

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》

Note: The specific requirements of Bachelor's Degree courses can be referred to the Provisions on the Level Review System of Bachelor's Degree Courses of Shenyang University of Chemical Technology.

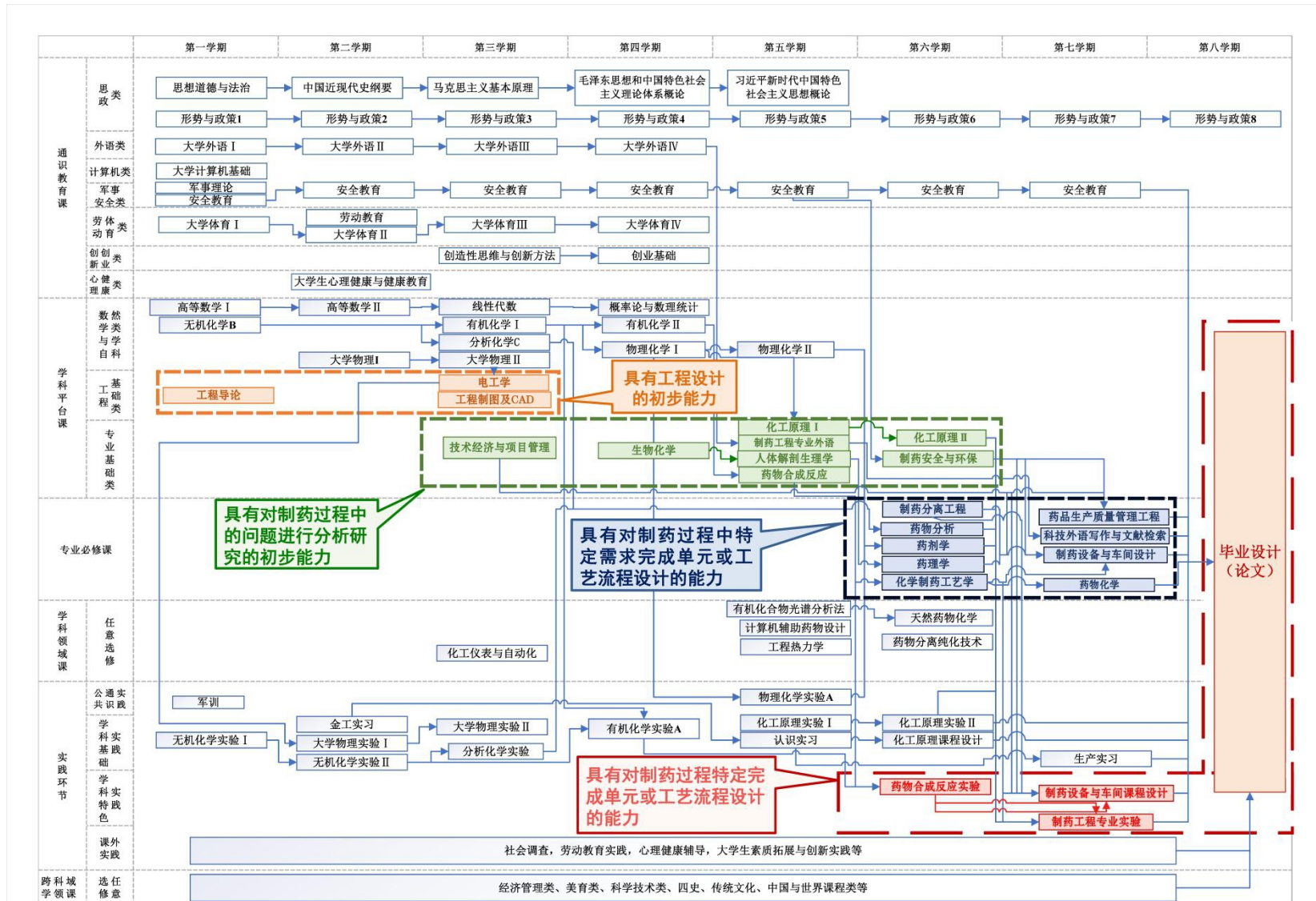
### 十一、全学期实践环节周历安排 Weekly Calendar of all Practice Sessions

学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注
一		☆	☆															::	::	·		
二		※	※															::	::	·		
三																		::	::	·		
四																		::	::	·		
五	▼	▼																::	::	·		
六	△L 分散	△L 分散	△L 分散	△L 分散	△L 分散	△L 分散	△L 分散	△L 分散	△L 分散	△L 分散	△L 分散	△L 分散						::	::	·		
七	/	/	△L 分散	△L 分散	△L 分散	△L 分散	△L 分散	△L 分散	△L 分散	△L 分散	△L 分散	△L 分散						::	::	·		
八	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=					

符号说明(Symbol Description):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P  
 各类实训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼ 认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计  
 (论文) ||Graduation Project(Thesis)    ·小学期||Primary Term

## 十二、课程体系配置图 Curriculum System Configuration Diagram



十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements ( High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																	
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	11.1	11.2	12.1	12.2		
思想道德与法治    Ideological Morality and the Rule of Law																							H	M	M									
中国近现代史纲要    Outline Chinese Contemporary and Modern History																							M											
马克思主义基本原理概论*    Elementary Theory of Marxism*																							H	M						L				
习近平新时代中国特色社会主义思想概论    Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																					H		H	M	M									
毛泽东思想和中国特色社会主义理论体系概论    Mao Zedong Thought and Theory of Socialism with Chinese Characteristics																							H	M										
形势与政策    Current Situation and Policies																			M		H		M							M				
大学外语    College English																												M	H					M
大学计算机基础    Fundamentals of Computer														M		H																		M
军事理论    Military Theory																							M					L						
安全教育    Safety Education											M																					L		







课程 (Courses)	毕业能力要求 (Graduation Requirements)																																	
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	11.1	11.2	12.1	12.2		
人体解剖生理学    Human Anatomy and Physiology	L																																	
药理学*    Pharmacology	M																																	
药物合成反应*    Drug Synthetic Reaction						H					M																							
制药工程专业外语    Special English of Pharmaceutical Engineering																														M				
外文科技论文写作与文献检索    English Research Paper Writing and Literature Retrieval										H																				M				
金工实习    Metalworking Practice										M														M			M							
药物化学*    Medicinal Chemistry				M						H																								
药剂学*    Pharmacy				M						M																								
药物分析*    Pharmaceutical Analysis					H	H					M																							
制药分离工程*    Separation Engineering of Pharmaceutical													H		M																			
制药安全与环保    Security and Environmental Protection in Pharmaceutical Process																																		
制药设备与车间设计*    Pharmaceutical Equipment and Workshop Design												M																				M		
化学制药工艺学*    Chemical Pharmaceutical Technology					H						H																							
药品生产质量管理工程    Quality Management Engineering of Pharmaceutical Production													H																			M		

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2	6.3	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	11.1	11.2	12.1	12.2	
认识实习    Cognition Practice																	H				M					H							
生产实习    Produce Practice																	H				M			M	H		M			M			
药物合成反应实验    Drug Synthesis Reaction Experiment											M		H																				
毕业设计(论文)    Graduation Design (Thesis)													M			H			H								H					H	
制药设备与车间课程设计    Course Design of Pharmaceutical Equipment and Workshop										M						M																	
制药工程专业实验    Speciality Experimental of Pharmaceutical Engineering											M		H		M	M																	
技术经济与项目管理    Technical Economy and Project of Pharmaceutical Engineering																														H	H		

# 沈阳化工大学本科培养方案

## 制药与生物工程学院

专业名称：食品科学与工程

专业代码：0082701

制 定：李东华

审 核：张 卉

审 定：于三三

批 准：金志浩

2021年8月

# 食品科学与工程专业培养方案

## 一、培养目标

本专业培养德智体美劳全面发展，具备良好的人文修养和社会责任感，具备化学、生物学、工程学、食品科学与技术的基本理论知识，拥有工程实践能力和创新创业能力，能解决复杂工程问题，在食品工业相关领域从事生产技术管理、品质检测与控制、工程设计、产品研发和技术推广等工作的应用型工程技术人才，成为自觉服务国家的社会主义事业合格建设者和可靠接班人。

本专业学生在毕业 5 年左右达到以下预测目标：

(1) 具有在食品行业及相关领域工作中分析和解决较复杂工程问题的能力，能够应用食品科学与工程原理、工程设计基本理论，在分析和解决食品相关领域现实工程问题和实践应用方面发挥有效作用；

(2) 具备食品工程技术研发能力和创新意识，能够秉持社会可持续发展理念，并遵循经济、环境、法律、安全和行业规范等要求，创造性的运用所学知识，推动技术研究、产品开发、生产及项目管理等工作的有效开展；

(3) 具备良好的人文科学素养、高度的社会责任感，能够在食品工程实践中理解并遵守工程职业道德规范，具有国际视野和较强的沟通、团队合作与领导能力；

(4) 能够通过继续教育或其他学习渠道更新知识，实现能力和技术水平的提升，自觉服务社会。

## 二、专业方向

食品科学与工程

## 三、毕业要求

毕业能力要求及其指标点分解如下：

毕业能力要求	指标点
毕业要求 1 工程知识： 能够将数学、自然科学、工程基础和食品科学与工程专业知识应用于解决复杂食品工程问题。	1-1.能够将数学、自然科学和工程基础知识及理论，用于对食品工程相关复杂工程问题的表述；
	1-2.能够针对食品制造与加工过程中的复杂工程问题建立数学模型并求解。
	1-3.能够将相关知识和数学模型方法用于推演、分析食品制造与加工过程中的工程应用问题。
	1-4. 能够将食品科学与工程专业知识和数学模型方法用于食品工程相关复杂工程问题解决方案的比较与综合。
毕业要求 2 问题分析： 能够应用数学、自然科学、工程科学和食品加工制造过程的基本原理，识别、表达、并通过文献研究分析复杂食品工程问题，得出有效结论。	2-1.能够根据数学、自然科学和食品科学与工程的基本原理，识别和判断食品工程相关复杂工程问题的关键环节。
	2-2.能够运用相关科学原理和数学模型方法，正确表达食品工程相关复杂工程问题。
	2-3.能认识到解决问题有多种方案可选择，会通过文献研究寻求可替代的解决方案，并能够基于食品工程相关知识基本原理并借助文献研究，分析食品加工与制造过程中的影响因素，获得有效结论。
毕业要求 3 设计/开发解决方案： 能够设计复杂食品工程问题的解决方案，设计满足特定需求的系统、单元或工艺流程，能够在设计环节中体现创新意识，并在设计或开发的过程中考虑社会、健康、安全、法律、文化及环境因素。	3-1.掌握食品加工过程工艺设计和产品开发的方法和技术，了解影响设计目标和技术方案的各种因素。
	3-2.能够针对具体的食品工程问题，设计满足特定需求的单元（部件）。
	3-3.能够针对复杂食品工程问题设计解决方案，进行系统或工艺流程设计，并改进和优化，设计过程中体现创新意识。
	3-4.在食品加工工艺设计和产品开发过程中能考虑社会、健康、安全、法律、文化及环境等制约因素。

<p>毕业要求 4</p> <p>研究：</p> <p>能够基于科学原理并采用科学方法对复杂食品工程问题进行研究，包括确定目标、设计实验、实验数据整理与分析、并通过信息综合得到合理有效的结论。</p>	4-1.能够基于科学原理，通过文献研究或相关方法，调研和分析食品工程相关复杂工程问题的解决方案。
	4-2.能够根据食品工程相关复杂工程问题的特征，选择适宜的技术路线，设计实验方案。
	4-3.能够根据设计的实验方案，组装、构建实验系统，保障实验的安全进行，实现数据的正确采集。
	4-4.能够对所获取实验结果进行辨别、分析、解构、关联和解释，得到合理的结论。
<p>毕业要求 5</p> <p>使用现代工具：</p> <p>能够针对复杂食品工程及相关领域问题，开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具，包括对复杂食品工程问题的预测与模拟，并能够理解其局限性。</p>	5-1.了解食品科学与工程专业常用的现代仪器、信息技术工具、工程工具和模拟软件的使用原理和方法，并理解其局限性。
	5-2.能够选择和使用现代仪器、CAD、专业数据库及模拟软件等，对复杂食品工程问题进行分析、计算与设计。
	5-3.能开发、选用恰当的现代工具模拟与预测食品领域的专业问题，并能够分析其局限性。
<p>毕业要求 6</p> <p>工程与社会：</p> <p>能够基于食品工程相关背景知识进行合理分析，评价食品专业工程实践和复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。</p>	6-1.熟悉食品工程及相关行业的生产、设计、研发及环境保护等方面的技术标准体系、知识产权、产业政策和法律法规，理解不同社会文化对工程活动的影响。
	6-2.能够分析评价现有食品生产实践和复杂工程问题解决方案可能对社会、健康、安全、法律以及文化的影响，以及这些制约因素对项目实施的影响，理解应承担的责任。
<p>毕业要求 7</p> <p>环境和可持续发展：</p> <p>理解并关注环境、资源和可持续发展的内涵与意义，能够理解和评价复杂的食品工程问题的工程实践对环境、社会可持续发展的影响。</p>	7-1.知晓和理解环境保护和可持续发展的理念和内涵，建立环境保护和可持续发展意识，能够理解并正确评估食品工程产品生产实践全过程可能对人类和环境造成的损害和隐患。
	7-2.在工程实践中能够评价并自觉应用节能环保、促进社会可持续发展的先进技术。
<p>毕业要求 8</p> <p>职业规范：</p> <p>具有人文社会科学素养、社会责任感，能够在食品科学与工程专业实践中理解并遵守工程职业道德规范，履行食品行业责任。</p>	8-1.具备良好的道德品质和人文社会科学素养，树立和践行社会主义核心价值观，理解个人与社会的关系，了解中国国情，明确个人作为社会主义事业建设者和接班人所肩负的责任和使命。
	8-2.理解诚实公正、诚信守则的工程职业道德和规范，能在工程实践中自觉遵守。
	8-3.理解食品工程师对公众的安全、健康和福祉，以及环境保护的社会责任，能够在工程实践中自觉履行责任。
<p>毕业要求 9</p> <p>个人和团队：</p> <p>有较强的团队意识和健全的人格，能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。</p>	9-1.能够与其他学科的成员有效沟通交流，在团队中独立或合作开展工作；
	9-2.理解团队中各角色对整个团队的意义，能够组织、协调和指挥团队有效开展工作。
<p>毕业要求 10</p> <p>沟通：</p> <p>能够就复杂食品工程问题与业界同行及社会公众进行有效沟通和交流，包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。具有国际化视野和现代意识以及健康的人际交往意识，能够在跨文化背景下进行沟通和交流。</p>	10-1.能够运用专业术语以口头、文稿和图表等方式就复杂食品工程问题与同行和公众进行有效的沟通和交流。
	10-2.了解食品学科国际发展趋势、研究热点，理解和尊重全球不同文化的差异性和多样性；
	10-3.具有跨文化交流的语言和书面表达能力，能就食品工程相关复杂工程问题，在跨文化背景下进行基本沟通和交流。
<p>毕业要求 11</p> <p>项目管理：</p> <p>理解并掌握食品科学与工程管理原理与经济决策方法，并能在多学科环境中应用。</p>	11-1.掌握食品工程项目管理原理与经济决策方法，理解食品生产全周期、全流程的成本构成及其中涉及的工程管理与经济决策问题。
	11-2.能在多学科环境下，将工程管理原理和经济决策方法综合应用于食品工业化制造工程项目管理。

毕业要求 12 终身学习： 具有自主学习和终身学习的意识，有不断学习和适应行业领域和经济社会发展的能力。	12-1.能在社会发展的大背景下了解食品科学与工程行业发展的新趋势，认识到不断探索和学习的必要性，具有自主学习和终身学习的意识；
	12-2.具有良好的自主学习能力，包括对技术资料进行分析、归纳总结及提出问题的能力，能够适应科技进步对职业能力的新的要求。

### 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标			
	培养目标 1	培养目标 2	培养目标 3	培养目标 4
1: 工程知识	√			
2: 问题分析	√	√		
3: 设计/开发解决方案	√	√		
4: 研究	√	√		
5: 使用现代工具	√	√		
6: 工程与社会		√		√
7: 环境和可持续发展		√		
8: 职业规范			√	√
9: 个人和团队			√	
10: 沟通			√	
11: 项目管理		√		
12: 终身学习	√	√	√	√

#### 四、主干学科

食品科学与工程

#### 五、专业核心课程

生物化学、微生物学、化工原理、食品化学、食品技术原理、食品营养学、食品安全学、食品分析、食品工艺学、食品机械与设备、食品工厂设计与环境保护

#### 六、修业年限

本科基本学制 4 年，弹性学习年限 3-6 年，按照学分管理制度管理。

#### 七、授予学位

学生应至少修满 172.5 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者，可授予工学学士学位。

## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例(%)
通识教育课	通识教育必修课	思政类	必修	17	41	23.8
		外语类		12		
		计算机类		2		
		军事安全类		2		
		劳动体育类		5		
		创新创业类		2		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	1	8	4.6
		中国与世界(500)		1		
		四史(600)		1		
		经济管理类(700)		1		
		科学技术类(800)		2		
		传统文化(900)		2		
通识教育实践课	军训	实践	2	2	1.2	
学科平台课	学科基础课程	公共基础类	必修	73	73	70.4
		专业基础类				
	学科实践课程	-	实践			
专业教育课	专业核心课程	-	必修	17	42.5	
	专业选修课程	-	选修	5.5		
	专业实践课程	-	实践	20		
能力拓展课	专业特色课程	-	实践	6	6	
课外环节	课外通识实践	人文社会实践	课外实践	4		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
	生涯教育	成长规划类		1		
总学分/比例					172.5	100%



# Food Science and Engineering Major 2021 Undergraduate Education Program

## I. Educational Objectives

### 1. Educational Objectives

This major aims to cultivate undergraduates to be applied engineering and technical talents, builder and successor of socialist cause serving the nation by willingness who have a good and all-round moral, intellectual, physical and aesthetical grounding in addition to a hard-working spirit, have rich cultural scientific literacy and a high degree of social responsibility, master basic knowledge of chemistry, biology, engineering, food science and technology, have engineering practice competence and innovation and entrepreneurship ability, can solve complex engineering problems, and engage in food production and technology management, quality testing and control, engineering design, product development and technology popularization and other aspects in the food field (such as food enterprises and institutions). To be a qualified builder and reliable successor of the socialist cause serving the country consciously.

Graduates should obtain knowledge and competences as follows:

(1) Have the ability to analyze and solve complex engineering problems in the food industry and related fields, be able to apply the principles of food science and engineering technology and the basic theory of engineering design, and play an effective role in solving practical engineering problems and practical applications in food related fields.

(2) Have the ability of food engineering technology research and development and innovative consciousness, be able to adhere to the concept of social sustainability, and follow the requirements of economy, environment, law, safety and industry norms, use of knowledge creatively and promote the effective development of technology research, product development, production and project management.

(3) Have rich cultural scientific literacy and a high degree of social responsibility, be able to understand and adhere to the Code of Engineering Ethics in the food engineering practice and have an international perspective and strong communication, team cooperation and leadership skills.

(4) Ability to update knowledge through continuing education or other learning channels to achieve an increased level of competence and skills and to serve the society consciously.

## II. Major direction

Food Science and Engineering

### III. Graduation Requirements

Graduates should obtain knowledge and competences as follows:

Graduation Requirements	Indices
Requirements1 ——Engineering Knowledge: Ability to apply expertise in mathematics, natural sciences, basic engineering and food science and engineering to solve complex engineering problems.	1-1. Ability to use mathematics, science, engineering fundamentals and expertise to describe complex food engineering problems appropriately
	1-2. Ability to establish an appropriate mathematical model for describing complex food processing unit operations or processes, and for solving complex engineering problems.
	1-3. Ability to apply food expertise to food engineering solutions, design, control and improvement of food processing processes
	1-4. Ability to apply professional knowledge to the selection of food processing technology and production equipment, capable of food processing process engineering design and quality and safety control engineering design.
Requirements2 ——Problem Analysis: Ability to apply mathematics, natural science, engineering science and the basic principles of food processing and manufacturing process, identify, express, and analyze complex engineering problems in the process of food industrial manufacturing through literature research, and draw effective conclusions.	2-1. Ability to apply the basic principles of food science and engineering to identify and judge key processes in the industrial production and quality control of food.
	2-2. Ability to apply scientific principles and mathematical models of food processing process to express complex engineering problems in industrial food manufacturing process and quality control.
	2-3. Ability to apply the professional knowledge of food science and engineering combined with literature research, analyze the influencing factors of complex engineering problems in the process of food industrial manufacturing and obtain effective conclusions.
Requirements3 ——Design/Development Solutions: Ability to grasp the integrated use of the theory of knowledge, design for complex engineering problems in the field of food industrial manufacturing and related solutions, designed to meet the specific needs of the system, unit, or process, be able to be reflected in the design process innovation consciousness, and to consider in the process of design and development of the society, health, safety, legal, cultural, and environmental factors.	3-1. Ability to master the methods and techniques of food processing process design and product development, and understand the various factors that affect the design objectives and technical solutions.
	3-2. Ability to complete unit or process design according to the specific needs of food industrial manufacturing process.
	3-3. Be able to design systems or technological process for the specific needs of food industrial manufacturing and processing, and reflect the sense of innovation in the design process.
	3-4. Ability to design food processing process and develop product, considering social, health, safety, legal, cultural and environmental constraints.
Requirements4 ——Research: Ability to conduct research on complex scientific and engineering problems in industrial food manufacturing based on scientific principles and using scientific	4-1. Be able to investigate and analyze solutions to complex engineering problems in food industrial manufacturing and processing based on scientific principles, through literature research or related methods.
	4-2. Be able to select appropriate technical routes and design experimental programs according to the characteristics of complex engineering problems in food industrial manufacturing, processing, etc.

<p>methods, including designing experiments, analyzing and interpreting data, and drawing reasonable and effective conclusions through information synthesis.</p>	<p>4-3. Ability to construct experimental system according to experimental scheme, carry out experiments scientifically, rigorously and safely, and collect complete and reliable experimental data correctly.</p>
	<p>4-4. Ability to compare, summarize, analyze and explain the experimental results, and get reasonable and effective conclusions.</p>
<p>Requirements5          ——Use Modern Tools:          Ability to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for complex food engineering and related issues, including simulation and prediction of complex professional problems in industrial food manufacturing, and understand their limitations.</p>	<p>5-1.Ability to understand the principles and methods of using modern instruments, information technology tools, engineering tools and simulation software commonly used in food science and engineering majors, and understand their limitations.</p>
	<p>5-2.Ability to choose and use modern instruments, CAD, professional database and simulation software, etc., to analyze, calculate and design complex engineering problems in the process of industrial food manufacturing and processing.</p>
	<p>5-3.Ability to develop, choose appropriate modern tools to simulate and predict professional problems in the process of industrial food manufacturing, and be able to analyze their limitations.</p>
<p>Requirements6          ——Engineering and Society:          Ability to rationally analysis and evaluate the social, health, safety, legal and cultural impact of professional engineering practices and solve complex engineering problems based on engineering background knowledge, and understand the responsibilities to be assumed</p>	<p>6-1.Ability to be familiar with technical standard system, intellectual property rights, industrial policies and laws and regulations related with manufacturing industry, and understand the influence of different social cultures on engineering activities.</p>
	<p>6-2.Ability to analyze and evaluate the influence of existing food production practices and complex engineering problems on social, health, safety, legal and cultural implications, as well as the influence on project implementation, and understand the responsibilities should be borne.</p>
<p>Requirements7          ——Environment and Sustainable:          Ability to understand and evaluate the impact of engineering practices on the sustainable development of the environment and society in the process of industrial food manufacturing.</p>	<p>7-1. Know and understand the concept and connotation of environmental protection and sustainable development, establish an awareness of environmental protection and sustainable development, and be able to understand and correctly assess the possible damage and potential hazards to humans and the environment throughout the production practices of bioengineering products.</p>
	<p>7-2. Be able to evaluate and consciously apply advanced technologies in engineering practice that are energy efficient and environmentally friendly and promote sustainable social development</p>
<p>Requirements8          ——Professional Norms:          Ability to understand and abide by the engineering professional ethics and fulfill the responsibility in the industrial food manufacturing engineering practice with humanistic and social science literacy and social responsibility.</p>	<p>8-1.Ability to have good moral character and humanistic and social science literacy, establish and practise socialist core values, understand the relationship between the individual and society, understand China's national conditions, and clarify the responsibilities and missions of individuals as builders and successors of the socialist cause.</p>
	<p>8-2.Ability to understand the engineering professional ethics and codes of honesty, fairness and integrity, and be able to consciously abide by them in the engineering practice of industrial food manufacturing.</p>

	8-3.Ability to understand the social responsibility of food engineers for public safety, health and well-being, as well as environmental protection, and be able to carry out their responsibilities in engineering practice.
Requirements9 ——Individuals and Teams: Ability to assume the roles of individual, team member and leader in a multi-disciplinary team. with strong team consciousness and sound personality.	9-1.Ability to understand the relationship between individuals and teams in a multidisciplinary context, have a good sense of teamwork and ability to effectively communicate with members of other disciplines and to complete individual tasks.
	9-2.Ability to organize and coordinate multi-disciplinary project team work tasks and organize the implementation.
Requirements10 ——Communicate: Ability to effectively communicate and communicate with colleagues and the public on complex engineering issues, including writing reports and designing documents, making presentations, and clearly expressing or responding to instructions with international vision and modern consciousness as well as with healthy sense of interpersonal communication in a cross-cultural context.	10-1.Ability to express opinions clearly and respond to questions and effectively communicate with industry peers and the public on complex engineering issues related to industrial food manufacturing by writing reports, designing documents and making presentations.
	10-2.Ability to understand the international development trends and research hotspots in the field of industrial food manufacturing, and understand the differences and diversity between different cultures and technological behaviors.
	10-3.Ability to communicate in language and writing across cultures, and be able to conduct basic communication and exchange on the professional issues of industrial food manufacturing in a cross-cultural context.
Requirements11 ——Project Management: Ability to understand and master engineering management principles and economic decision methods and be able to apply them in a multidisciplinary environment.	11-1.Ability to master the principles of engineering management and economic decision-making in food industrial manufacturing and related fields, understand the cost structure of the whole process of food production and the issues of engineering management and economic decision-making involved.
	11-2.Ability to apply the principle of engineering management and economic decision-making method to the industrial food manufacturing engineering project management in a multidisciplinary environment.
Requirements 12 ——Lifelong Learning: Ability to have the consciousness of self-learning and lifelong learning, and have the ability to continuously learn and adapt to the development of the industry, economy and society.	12-1.Ability to realize the necessity of continuous exploration and learning, Be able to understand the new trend of food industry under the background of social development, and have the consciousness of independent learning and lifelong learning in the context of social development.
	12-2.Ability to have good self-learning ability, including the ability to analyze, summarize and ask questions about technical data, and be able to adapt to the new requirements of technological progress on vocational ability.

## The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives			
	Educational Objectives 1	Educational Objectives 2	Educational Objectives 3	Educational Objectives 4
1: Engineering Knowledge	√			
2: Problem Analysis	√	√		
3: Design/Development Solutions	√	√		
4: Research	√	√		
5: Use Modern Tools	√	√		
6: Engineering and Society		√		√
7: Environment and Sustainable Development		√		
8: Career Planning			√	√
9: Individuals and Teams			√	
10: Communicate			√	
11: Project Management		√		
12: Lifelong Learning	√	√	√	√

### IV. Major Subject

Food Science and Engineering

### V. Core Courses

Biochemistry、Microbiology、Unit Operations of Chemical、Food Chemistry、Principles of Food Technology、Food Nutriology、Food Safety、Food Analysis、Food Processing Technology、Food Machinery and Equipment、Food Factory Design and Environmental Protection.

### VI. Educational System

The basic length of undergraduate education is 4 years, and the flexible study period is 3-6 years, which is managed according to the credit system.

### VII. Confer Degrees

Students should complete at least 172.5 credits to graduate. Those who meet "the Requirements of the Degree Awarding Regulations of Shenyang University of Chemical Technology (Revised in March 2017)" will be awarded the Bachelor of Engineering degree.

## VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit requirement	Subtotal	Proportion (%)
General Education	General Education (Compulsory)	Ideological and Political Courses	Compulsory	17	41	23.8
		Foreign Language Courses		12		
		Computer Courses		2		
		Military and Safety Courses		2		
		Labor and Sport Education		5		
		Innovation and Entrepreneurship		2		
		Mental Health		1		
	General Education (Optional)	Aesthetic Education(400)	Optional	1	8	4.6
		China and the world(500)		1		
		Four Histories(600)		1		
		Economic Management(700)		1		
		Science and technology(800)		2		
		TraditionalCulture(900)		2		
Discipline Education	Basic Courses	Public basic class	Compulsory	73	73	70.4
		Professional foundation				
	Basic Practice Sessions	-	Practice			
Specialized Education	Core Courses	-	Compulsory	17	42.5	70.4
	Optional Courses	-	Optional	5.5		
	Specialized Practice Sessions	-	Practice	20		
Competency Development	Individualized Courses	-	Practice	6	6	
Extracurricular links	Extracurricular General Education Practice	Culture and Society Practice	Extracurricular Practice	4		
		Mentally and Physically Practice				
		Foreign Language Proficiency Training Practice				
	Extracurricular Characteristic Practice	Innovative Training		4		
		Innovation Competition				
		Chuangke activities				
	Career Education	Growth Planning Courses		1		
Total/Proportion					172.5	100%

## 九、食品科学与工程专业教学进程表

### Table of Teaching Schedule for Food Science and Engineering Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.e	一	二	三	四	五	六	七	八			
											1st	2nd	3rd	4th	5th	6th	7th	8th			
通识教育课 General Education	必修 Compulsory		思政类 Ideological and Political Courses	0710093001	思想道德与法治    Ideological Morality and the Rule of Law	3.0	48	32			16	2									
				0710053001	中国近现代史纲要   Outline of Chinese Contemporary and Modern History	3.0	48	32			16		2								
				0710103001	马克思主义基本原理*   Basic Principles of Marxism*	3.0	48	32			16			2							
				0710123001	习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8					3					
				0710133001	毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3.0	48	32			16				2						
				0710012301	形势与政策   Current Situation and Policies	2.0	64	64				2	2	2	2	2	2	2	2	2	
	外语类 Foreign Language Courses			0211003101	大学外语I   College EnglishI	3.0	48	48				3									
				0211003201	大学外语II*   College English II*	3.0	48	48					3								
				0241003301	大学外语III   College English III	3.0	48	48						3							
					大学外语III（进阶英语）    College English III（Advanced English CET 6-Orientated）	3.0	48	48							3						五选一

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.e	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
通识教育课 General Education	必修 Compulsory	外语类 Foreign Language Courses	0241003301	大学外语III（英语口语表达与交流）    College English III（English Oral Expression and Communication）	3.0	48	48					3							五选一	
				大学外语III（跨文化交际）    College English III（Intercultural Communication）	3.0	48	48				3									
				大学外语III（英语写作表达与交流）    College English III（English Writing Expression and Communication）	3.0	48	48				3									
			大学外语IV*   College English IV*	3.0	48	48						3								
			大学外语IV（进阶英语）    College EnglishIV（Advanced English CET 6-Orientated）	3.0	48	48							3							
			大学外语IV（英语口语表达与交流）    College EnglishIV（English Oral Expression and Communication）	3.0	48	48							3							
		0241003401	大学外语IV（跨文化交际）    College English IV（Intercultural Communication）	3.0	48	48							3							
			大学外语IV（英语写作表达与交流）    College English IV（English Writing Expression and Communication）	3.0	48	48							3							
			计算机类 Computer Courses	1613242001	大学计算机基础   Fundamentals of Computer	2.0	36	24			12		2							
			军事安全类 Military and Safety	0710081001	军事理论   Military Theory	1.0	16	16					2							





学科平台课 Discipline Education	必修 Compulsory	数学与自然科 学类 Natural Science & Mathematics	031005201	高等数学 II*   Advanced Mathematics II*	5.5	96	88			8	6									
			0310063101	大学物理 I*   University Physics I*	3.0	48	46	2				3								
			0310063201	大学物理 II*   University Physics II*	3.0	48	46	2					3							
			0310032001	线性代数    Linear Algebra	2.0	32	32						2							
			0310042001	概率论与数理统计   Probability and Statistics	2.0	32	32							2						
			0319022001	无机化学 B*   Inorganic Chemistry B*	2.0	32	32				2									
			0319042001	分析化学 A*   Analytical Chemistry A*	2.0	32	32						2							
			0319123001	物理化学*   Physical Chemistry *	3.0	48	48						3							
			0319072001	有机化学 D*    Organic Chemistry D*	2.5	40	40						3							
		工程基础类 Foundation Engineering	1510122001	电工学   Electrical Engineering	2.5	44	32	12					3							
			2118004001	工程制图及 CAD    Engineering Drawing & CAD	4.0	68	56		12				4							
		工程基础类 Foundation Engineering	2110111001	过程装备机械设计基础   Mechanical design basis of process equipment	1	16	16							2						
			1110014001	化工原理*   Unit Operations of Chemical Engineering*	4.0	64	64								4					
				1911011002	食品科学与工程导论   Introduction to food science and engineering	1	16	16				2								

学科平台课 Discipline Education	必修 Compulsory	专业基础类 Subject Foundation Requisite	1911061002	食品科学与工程专业外语   English for Food Science and Engineering	1.5	24	24								2				
			1911093002	生物化学*   Biochemistry*	3	48	48					3							
			1911103002	微生物学*   Microbiology*	3	48	48						3						
			1911142002	食品化学*   Food Chemistry *	2.5	40	40								3				
			1911042002	食品营养学*   Food Nutriology*	2	32	32								3				
			1911152002	食品技术原理*   Principles of Food Technology*	2.5	40	40								3				
			1911092002	食品安全学*   Food Safety*	2	32	32									3			
			小计 Subtotal				58.5	960	916	16	12	16	11	15	19	7	15	3	
	实践 Practice	0311061111	无机化学实验 I   Inorganic Chemistry experiment I	1.0	24		24				4								
		0310081011	大学物理实验   Physical experiment of college	1	24	6	18					3							
		0313141011	分析化学实验   Experiments in Analytical Chemistry	1.0	24		24					4							
		0312081011	有机化学实验 A   Organic Chemistry Experiment A	1.5	36	0	36	0	0		6								
		0319221011	物理化学实验 A   Experiments in Physical Chemistry A	1.5	36	4	32						4						
		1110041111	化工原理实验 I   Experiment for Unit Operations of Chemical Engineering I	1	24		24									3			
		1110032021	化工原理课程设计   Curriculum project for Unit Operations of Chemical Engineering	2	48	48											4		
1910011012		生物化学实验   Experiment for Biochemistry	1.5	36		36					3								



专业教育课 Specialized Education	选修 Optional		Food Additives																	
		1930051002	食品包装技术与设备   Technology and Equipment of Food Package	1.5	24	24									2					
		1930061002	计算机在食品工程中的应用   Application of Computer in Food Engineering	1	16	16											2			
		1930071002	工业微生物育种学   Breeding of industrial microorganisms	1.5	24	24									2					
		1930081002	细胞与分子生物学   Cell and Molecular Biology	1.5	24	24									2					
		1930091002	食品物流学   Food Logistics	1.5	24	24								2						
		1930101002	食品营销学   Food Marketing	1.5	24	24									2					
		1930111002	食品酶学   Food Enzymology	1.5	24	24										2				
		小计 Subtotal		16	256	256								4	8	4	6			
		(此处填写修读要求 Fill in the Study Requirements) 专业选修课最少修满 5.5 学分																		
	实践 Practice	1914061032	认识实习   Cognition Practice	1										+1						
		1914084032	生产实习   Production Practice	2											+2					
		1910031012	食品化学实验   Experiment for Food Chemistry	1	24	24								2						
		1910041012	食品工艺实验   Experiment for Food Processing Technology	1	24	24									2				CDIO 课程	
		1910051012	食品分析实验   Experiment for Food Analysis	1	24	24									2					
		1914091042	毕业设计(论文)   Graduation Design (Thesis)	14														+14		CDIO 课程

			小计 Subtotal	20																	
			合计 Total	53																	
能力拓展课 Competency Development	实践 Practice	1910072012	食品产品设计与开发   Food Product Design and Development	2	48									4							
		1910062012	食品专业综合实验   Comprehensive Experiment of Food Specialty	2	48											4				CDIO 课程	
		1910022022	食品工厂设计与环境保护课程设计    Course Design of Food Factory Design and Environmental Protection	2	48													+2			
		小计 Subtotal			6	144															
		(此处填写修读要求 Fill in the Study Requirements) 能力拓展课最少修满 6 学分																			
总计 Sum				172.5						19.5	24.5	30	19.5	20.5	22	21.5	16				
课外环节 Extracurricular links	课外实践 Extracurricular practice	人文社会实践 Culture and Society Practice	1931020052	社会调查   Social Survey	0.5	12				12								0.5	分散		
		身心健康社会 实践 Mentally and Physically Practice	0410050751	课外体育锻炼   Extracurricular Physical Exercise	0.5	12				12								0.5	分散		
			2640030011	劳动教育实践   Labour Education Practice	0.5	12				12		0.5								分散	
			0510070311	心理健康辅导   Mental Health Counseling	0.5	12				12								+0.5			
		外语技能实践类 Foreign Language Proficiency Training Practice	0210010011	外语技能实践（初级）   Foreign Language Proficiency Training Practice (elementary)	2.0	48				48					2						二选一
			0210020011	外语技能实践（高级）   Foreign Language Proficiency Training Practice (advanced)	2.0	48				48					2						

课外环节 Extracurricular links	课外实践 Extracurricular practice	能力与创新实践 Capability and Innovation Practice	1910014852	大学生素质拓展与创新实践   Quality Development and Innovation Practice	4.0	96					96	1~8 学期依据《沈阳化工大学创新创业实践学分认定办法》由创新创业学院认定						分散
		成长规划类 Growth Planning Courses	1910561012	职业规划与就业指导   Career Planning and Employment Guidance	1.0	40	40					1					1	
小计 Subtotal																		

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5,课程名称中画\*为考试课。

Note: “Cre. (Credits)”, “T.C.H. (Total Credit Hours)”, “Lec. (Lecture)”, “Exp. (Experiment)”, “Pro. (Programming)”, “Pra. (Practice)”.

## 十、食品科学与工程专业学士学位课程一览表

**A list of bachelor's degree programs in Food Science and Engineering**

课程类别 Course Type	模块名称 Modules	序号 No.	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester	
通识教育课 General Education	政治理论 Political Theory	1	0710103001	马克思主义基本原理* Basic Principles of Marxism*	3	4	
		2	0710133001	毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3	4	
学科平台课 Discipline Education	数学 Mathematics	3	0310004101	高等数学I* Advanced Mathematics I*	4.5	1	
	物理 Physics	4	0310063101	大学物理I* University Physics I	3	2	
	化学基础 Foundations of Chemistry	5	0319072001	有机化学 D* Organic Chemistry D*	2.5	2	
	工程基础 Foundation Engineering	6	1110014001	化工原理* Unit Operations of Chemical Engineering*	4	5	
	专业基础 Subject Foundation Requisite		7	1911093002	生物化学* Biochemistry*	3	3
			8	1911103002	微生物学* Microbiology*	3	4
			9	1911142002	食品化学* Food Chemistry *	2.5	5
			10	1911152002	食品技术原理* Principles of Food Technology*	2.5	5
			11	1911042002	食品营养学* Food Nutriology*	2	5
			12	1911092002	食品安全学* Food Safety*	2	6
	专业教育课 Specialized Education	食品科学与工程类 Food science and Engineering	13	1911172002	食品机械与设备* Food Machinery and Equipment*	2	7
			14	1911122002	食品工厂设计与环境保护* Food Factory Design and Environmental Protection*	2	7
15			1911113002	食品工艺学* Food Processing Technology *	3.5	6	
16			1911162002	食品分析* Food Analysis*	2.5	6	

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》



### 十一、全学期实践环节周历安排 Weekly Calendar of all Practice Sessions

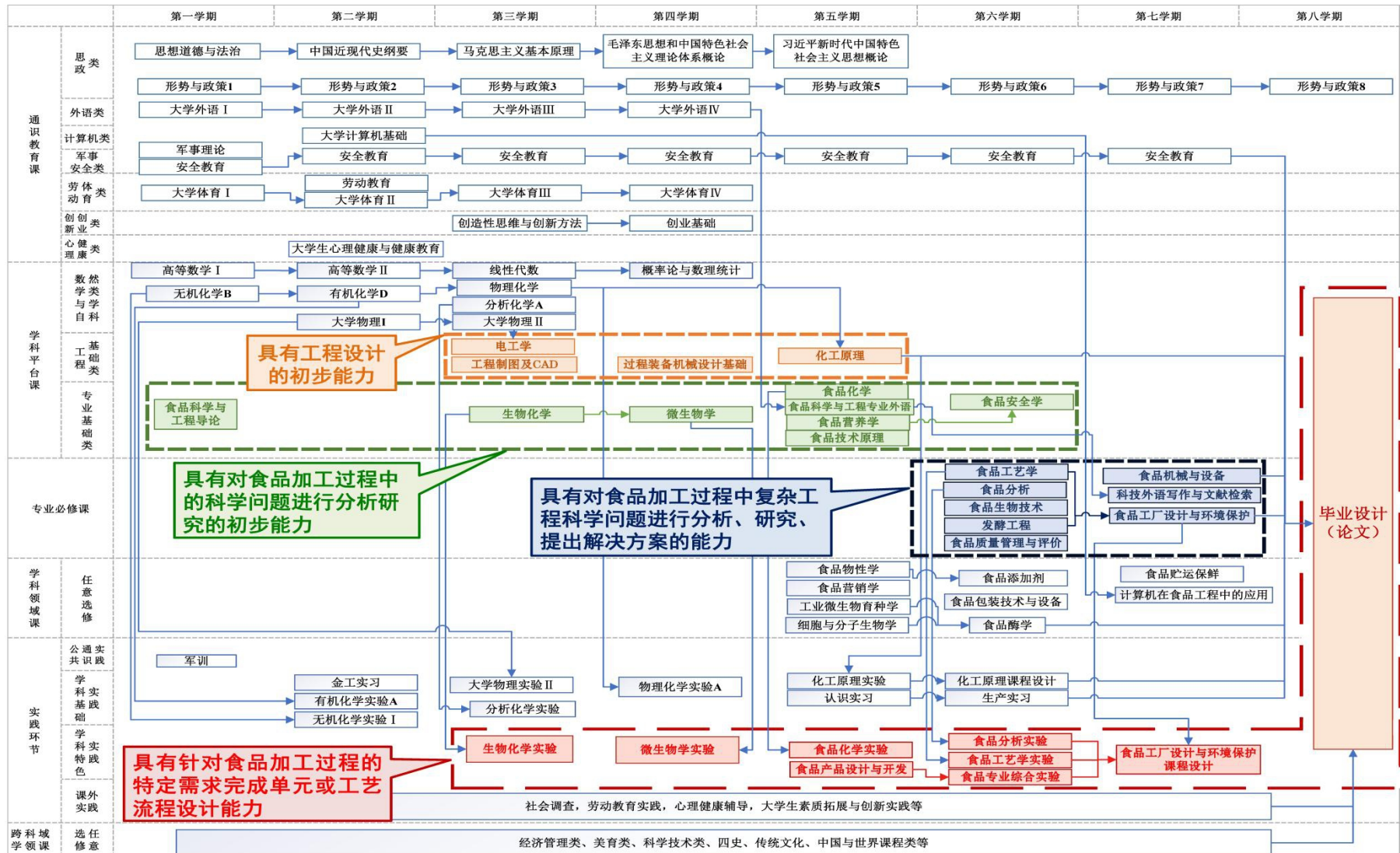
学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注
一		☆	☆															::	::	·		军训   Military Training
二																※	※	::	::	·		金工实习   Metalworking Practice
三																		::	::	·		
四																		::	::	·		
五	▼																	::	::	·		认识实习   Cognition Practice
六	/	/																::	::	·		生产实习   Specialized Production Practice
七																		::	::	·		
八	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=					毕业设计（论文）   Graduation Project(Thesis)

1251

#### 符号说明(Symbol Description):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P 各类实训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计（论文）||Graduation Project(Thesis) ·小学期||Primary Term

## 十二、课程体系配置图 Curriculum System Configuration Diagram



### 十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements (High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																		
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	11.1	11.2	12.1	12.2	
思想道德与法治   Ideological Morality and the Rule of Law																									H	M	M								
中国近现代史纲要   Outlineof Chinese Contemporaryand Modern History																								M						M					
马克思主义基本原理   Elementary Theory of Marxism																								M											
习近平新时代中国特色社会主义思想概 论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																						H		H	H	M									
毛泽东思想和中国特色社会主义理论体系 概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*																								H											
形势与政策   Current Situation and Policies																								M						M					
安全教育   Safety Education																				M		M		M											
劳动教育   Labour Education																								M		M		M							
大学外语   College English																												M		H					M
大学计算机基础   Fundamentals of Computer																M		M																	L



课程 (Courses)	毕业能力要求 (Graduation Requirements)																																		
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	11.1	11.2	12.1	12.2	
生物化学   Biochemistry			M		H							H																							
食品化学   Food Chemistry					H							H															M								
食品技术原理   Principles of Food Technology				M				H					L																						
微生物学   Microbiology							M					H																							L
仪器分析   Instrumental Analysis																H	M												L						
食品科学与工程专业外语   English for Food Science and Engineering																													M	H					
科技外语写作与文献检索   Scientific English Writing and Literature Retrieval							H																							M					
食品安全学   Food Safety							M				H	M																							
食品质量管理与评价   Food Quality Management and Evaluation												M							H							L									
食品分析 Food Analysis															H		M												M						
食品工艺学   Food Processing Technology								H		M											M														
食品生物技术   Food Biotechnology									H														M												
食品机械与设备 Food Machinery and Equipment							H		M						H																				
食品工厂设计与环境保护   Food Factory Design and Environmental Protection									H	M																							M		



课程 (Courses)	毕业能力要求 (Graduation Requirements)																																			
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	11.1	11.2	12.1	12.2		
无机化学实验 I   Inorganic Chemistry experiment I														H	M			M																		
分析化学实验   Experiments in Analytical Chemistry														H	M			M																		
有机化学实验 A   Organic Chemistry Experiment A														H	M			M																		
物理化学实验 A   Experiments in Physical Chemistry A														H	M			M																		
金工实习   Metalworking Practice								M																		L		M								
食品化学实验   Experiment for Food Chemistry							M							H																						
食品分析实验   Experiment for Food Analysis															H	M									M											
生物化学实验   Experiment for Biochemistry							M							H																						
微生物学实验   Experiment for Microbiology					M									H																						
认识实习 Cognition Practice																			M		M						M								L	
化工原理实验   Experiment for Unit Operations of Chemical Engineering														M														M								
化工原理课程设计   Curriculum project for Unit Operations of Chemical Engineering									H								M										H									
生产实习   Production Practice											M									M				H					M							
食品工厂设计与环境保护课程设计   Course Design of Food Factory Design and Environmental Protection									H								H						H											M		

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																			
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	11.1	11.2	12.1	12.2		
食品工艺学实验   Experiment for Food Processing Technology								H							L													M								
食品专业综合实验   Comprehensive Experiment of Food Specialty													H		M											M		M	M							
食品产品设计与开发   Food Product Design and Development										H		M						M								L										
毕业论文 (设计)   Graduation Thesis (Design)											M							M		H		H						H								H
大学生素质拓展与创新创业实践   Quality Development and Innovation Practice																												H		H					M	M
社会调查   Social Survey																								M			M									L





# 沈阳化工大学本科培养方案

## 制药与生物工程学院

专业名称：生物工程

专业代码：083001

制 定：朱建星

审 核：张 卉

审 定：于三三

批 准：金志浩

2021 年 8 月

# 生物工程专业培养方案

## 一、培养目标

本专业培养德智体美劳全面发展，具备良好的人文修养和社会责任感，具备相关自然科学、生物学和工程学基本知识，能在生物工程及医药、化工等相关行业的生产企业、科研院所和管理部门等单位，从事设计、生产与管理和新产品开发、新技术研究的应用型工程技术人才，成为自觉服务国家的社会主义事业合格建设者和可靠接班人。

本专业学生在毕业5年左右达到以下预测目标：

(1) 能够运用生物工程科学原理和工程设计基本理论，分析和解决生物制造与加工过程中的复杂工程问题，以提升产品质量，提高生产效率和经济效益；

(2) 能够秉持社会可持续发展理念，并遵循经济、环境、法律、安全和行业规范等要求，创造性地运用所学知识，推动技术研究、开发及项目管理等工作的有效开展；

(3) 能够在生物工程实践中理解并遵守工程职业道德规范，具有国际视野和较强的沟通、团队合作能力；

(4) 能够通过继续教育或其它学习渠道更新知识，实现能力和技术水平的提升，自觉服务社会。

## 二、专业方向

生物工程

## 三、毕业要求

毕业能力要求及其指标点分解：

毕业能力要求	指标点
毕业要求 1： 能够将数学、自然科学、工程基础和生物工程专业知识用于解决生物制造与加工过程中的复杂工程问题。	1-1.掌握用于合理表述生物制造与加工过程中复杂工程问题的数学、自然科学知识。
	1-2.能够针对生物制造与加工过程中的复杂工程问题建立数学模型并求解。
	1-3.能够将相关知识和数学模型方法用于推演、分析生物制造与加工过程中的工程应用问题。
	1-4.能够将生物工程专业知识和数学模型用于生物制造与加工等过程中的复杂工程问题解决方案的比较与综合。
毕业要求 2： 能够应用数学、自然科学、工程科学和生物工程的基本原理，识别、表达、并通过文献研究分析生物制造与加工过程中的复杂工程问题，得出有效结论。	2-1.能够应用数学、自然科学、工程科学和生物工程的基本原理，对生物制造与加工等过程中的复杂工程问题的关键环节进行识别和判断。
	2-2.能够基于相关科学原理和数学模型方法正确表达生物制造与加工过程中的复杂工程问题。
	2-3.能认识到解决问题有多种方案可选择，会运用相关科学原理，结合文献研究，寻求可替代的解决方案，分析生物制造与加工过程中复杂工程问题的影响因素，获得有效结论。
毕业要求 3： 能够综合运用所掌握的理论知识，设计针对生物制造与加工过程中的复杂工程问题的解决方案，设计满足特定需求的系统、单元或工艺流程，能够在设计环节中体现创新意识，并在设计或开发的过程中考虑社会、健康、安全、法律、文化及环境因素。	3-1.掌握生物制造与加工过程工艺设计和产品开发全周期、全流程的基本设计/开发方法和技术，了解影响设计目标和技术方案的各种因素。
	3-2.能够针对生物制造与加工过程的特定需求完成单元设计。
	3-3.能够针对生物制造与加工过程的特定需求进行系统或工艺流程设计，并在设计过程中体现创新意识。
	3-4.在生物制造与加工过程工艺设计和产品开发过程中能考虑社会、健康、安全、法律、文化及环境等制约因素。
毕业要求 4：	4-1.能够基于科学原理，通过文献研究或相关方法，调研和分析生物制造与加工过程中的复杂工程问

能够基于科学原理并采用科学方法对生物制造与加工过程中复杂工程科学问题进行研究,包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。	题的解决方案。
	4-2.能根据生物制造与加工等过程中复杂工程问题的特征,选择适宜的技术路线,设计实验方案。
	4-3.能根据实验方案构建实验系统,科学、严谨、安全地开展实验,正确地采集完整可靠的实验数据。
	4-4.能对实验结果进行对比、归纳、分析和解释,得到合理有效的结论。
毕业要求 5: 能够针对复杂生物工程及相关领域问题,开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具,模拟与预测生物制造与加工等过程中的专业问题,并能够理解其局限性。	5-1.了解生物工程专业常用的现代仪器、信息技术工具、工程工具和模拟软件的使用原理和方法,并理解其局限性。
	5-2.能够选择和使用现代仪器、CAD、专业数据库及模拟软件等,对生物制造与加工等过程中的复杂工程问题进行分析、计算与设计。
	5-3.能开发、选用恰当的现代分析工具或软件模拟与预测生物制造与加工等过程中的专业问题,并能够分析其局限性。
毕业要求 6: 熟悉生物工程及其产业的相关政策和法规,能够基于工程相关背景知识进行合理分析,评价专业工程实践和复杂生物工程专业问题解决方案对社会、健康、安全、法律以及文化的影响,并理解应承担的责任。	6-1.熟悉生物化工及制药等行业相关的技术标准体系、知识产权、产业政策和法律法规,理解不同社会文化对工程活动的影响。
	6-2.能够分析评价现有生物工程实践和复杂生物工程专业问题解决方案可能对社会、健康、安全、法律以及文化的影响,以及这些制约因素对项目实施的影响,理解应承担的责任。
毕业要求 7: 能够理解和评价针对生物制造与加工过程中的复杂工程问题的工程实践对环境、社会可持续发展的影响。	7-1.知晓和理解环境保护和可持续发展的理念和内涵,建立环境保护和可持续发展意识,能够理解并正确评估生物工程产品生产实践全过程可能对人类和环境造成的损害和隐患。
	7-2.在工程实践中能够评价并自觉应用节能环保、促进社会可持续发展的先进技术。
毕业要求 8: 具有良好的人文社会科学素养、社会责任感,遵纪守法,诚信做人,能够在生物工程实践中理解并遵守工程职业道德规范,履行责任。	8-1.具备良好的道德品质和人文社会科学素养,树立和践行社会主义核心价值观,理解个人与社会的关系,了解中国国情,明确个人作为社会主义事业建设者和接班人所肩负的责任和使命。
	8-2.理解诚实公正、诚信守则的工程职业道德和规范,并在生物工程实践中自觉遵守。
	8-3.理解生物工程师对公众的安全、健康和福祉,以及环境保护的社会责任,能够在工程实践中自觉履行责任。
毕业要求 9: 有较强的团队意识和健全的人格,能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。	9-1.理解多学科背景下个人和团队的关系,具有良好的团队合作意识和能力,能与其他学科的成员进行有效沟通并能完成个人所承担的任务。
	9-2.能够组织协调多学科背景的项目团队工作任务并组织实施。
毕业要求 10: 能够就生物制造与加工过程中的复杂工程问题与业界同行及社会公众进行有效沟通和交流,包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。具有国际化视野和现代意识以及健康的人际交往意识,能够在跨文化背景下进行沟通和交流。	10-1.能够就生物制造与加工过程中的复杂工程问题,通过撰写报告、设计文稿和陈述发言等方式清晰地表达观点,回应质疑,与业界同行及社会公众进行有效沟通和交流。
	10-2.了解生物工程专业领域的国际发展趋势、研究热点,理解不同文化、技术行为之间的差异性和多样性。
	10-3.具有跨文化交流的语言和书面表达能力,能就生物工程专业问题,在跨文化背景下进行沟通和交流。
毕业要求 11: 理解并掌握工程管理原理与经济决策方法,并能在多学科环境中应用。	11-1.掌握生物工程项目中涉及的管理与经济决策方法。了解生物工程产品生产全周期、全流程的成本构成并理解其中涉及的工程管理与经济决策问题。
	11-2.能在多学科环境下,将工程管理原理和经济决策方法综合应用于解决生物制造与加工过程中的复杂工程问题。
毕业要求 12: 具有自主学习和终身学习的意识,有不断学习和适应发展的能力。	12-1.能够在社会发展的大背景下了解生物工程行业发展的新趋势,认识到自主和终身学习的必要性。
	12-2.具有良好的自主学习能力,包括对技术资料进行分析、归纳总结及提出问题的能力,能够适应科技进步对职业能力的要求。

专业毕业要求应该能够支撑培养目标的达成。建立本专业毕业要求支撑培养目标实现的关系矩阵。

## 毕业要求支撑培养目标实现的关系矩阵

毕业要求	培养目标			
	培养目标 1	培养目标 2	培养目标 3	培养目标 4
1: 工程知识	√			
2: 问题分析	√			
3: 设计/开发解决方案	√	√		
4: 研究	√	√		
5: 使用现代工具	√	√		
6: 工程与社会		√		√
7: 环境和可持续发展		√		
8: 职业规范			√	√
9: 个人和团队			√	
10: 沟通			√	
11: 项目管理		√		
12: 终身学习			√	√

### 四、主干学科

化学工程与技术

### 五、专业核心课程

普通生物学、生物化学、细胞生物学、微生物学、化工原理、分子生物学与基因工程、微生物工程、生物反应工程、生物分离工程、生物工程设备。

### 六、修业年限

本科基本学制 4 年，弹性学习年限 3-6 年，按照学分制度管理。

### 七、授予学位

学生应至少修满 174 学分方可毕业。符合《沈阳化工大学本科毕业生学士学位授予工作有关规定(2017 年 3 月修订)》学位授予条件者，可授予工学学士学位。

## 八、学分要求

课程类别	课程模块		课程性质	学分要求	小计	比例(%)
通识教育课	通识教育必修课	思政类	必修	17	41	23.6
		外语类		12		
		计算机类		2		
		军事安全类		2		
		劳动体育类		5		
		创新创业类		2		
		心理健康类		1		
	通识教育选修课	美育类(400)	选修	2	8	4.6
		中国与世界(500)		1		
		四史(600)		1		
		经济管理类(700)		1		
		科学技术类(800)		1		
		传统文化(900)		2		
通识教育实践课	军训	实践	2	2	1.1	
学科平台课	学科基础课程	公共基础类	必修	42	70.5	70.7
		专业基础类		16.5		
	学科实践课程	-	实践	12		
专业教育课	专业核心课程	-	必修	14.5	42.5	
	专业选修课程	-	选修	7		
	专业实践课程	-	实践	21		
能力拓展课	专业特色课程	-	实践	10	10	
课外环节	课外通识实践	人文社会实践	课外实践	4		
		身心健康实践				
		外语技能实践				
	创新创业实践	创新训练		4		
		创新大赛				
		创客活动				
	生涯教育	成长规划类				1
总学分/比例					174	100%



# Bioengineering Major 2021 Undergraduate Education Program

## I. Educational Objectives

### 1. Educational Objectives

The major cultivates applied talents in engineering and technology who are well-rounded development of moral, intellectual, physical, aesthetic and labor, along with good humanistic cultivation and social responsibility. They possess basic knowledge of natural science, biology and engineering, so they can engage in design, production, management, new product development and new technology research in manufacturing enterprises, research institutes and management departments of bioengineering, pharmaceutical and chemical industry. They will become qualified builders and reliable successors of the socialist cause serving the country consciously.

Graduates should obtain knowledge and competences as follows:

(1) To be able to apply the scientific principles of large-scale manufacturing of biological products, knowledge related to biological engineering and basic theories of engineering design to analyze and solve problems in the process of biological manufacturing and processing in order to improve product quality, production efficiency and economic benefits.

(2) The ability to creatively apply knowledge learned to promote effective development of technical research, product development and project management in a socially sustainable manner and in compliance with economic, environmental, legal, safety and industry norms, adhering to the concept of social sustainable development.

(3) Ability to understand and comply with the code of ethics for the engineering profession in bioengineering practice, with an international perspective and strong communication and teamwork skills.

(4) Ability to update knowledge through continuing education or other learning channels to achieve an increased level of competence and skills and to serve the society consciously.

## II. Major direction

Bioengineering

## III. Graduation Requirements

Graduates should obtain knowledge and competences as follows:

Graduation Requirements	Indices
Requirement 1: Have the ability to apply mathematics, natural sciences, engineering foundations and bioengineering expertise to solve complex engineering problems in biological manufacturing and processing.	1-1. Master the knowledge of the mathematics and natural sciences that are used to reasonably express complex engineering problems in biological manufacturing and processing.
	1-2. Be able to establish and solve mathematical models for cell growth and biological reactions during biological manufacturing and processing.
	1-3. Be able to apply relevant knowledge and mathematical model methods to deduce and analyze engineering application problems in biological manufacturing and processing.



	1-4. Be able to apply bioengineering expertise and mathematical models for the comparison and synthesis of solutions to complex engineering problems in biological manufacturing, processing and other processes.
<p>Requirement 2.</p> <p>Have the ability to apply the basic principles of mathematics, natural sciences, engineering sciences, biological manufacturing and processing processes, to identify, express, and analyze complex engineering problems in biological manufacturing and processing through literature research, and get valid conclusions.</p>	2-1. Be able to apply the basic principles of bioengineering to identify and judge the key links in the process of biological manufacturing and processing, such as cell culture, biological reactions, product separation and purification.
	2-2. Be able to correctly express complex engineering problems such as biological reactions, cell culture and product separation in the biological manufacturing and processing processes based on relevant scientific principles and mathematical modelling methods.
	2-3. Be able to recognize that there are multiple options for solving problems, seek alternative solutions through literature research and be able to apply bioengineering expertise, combined with literature research to analyze the influencing factors of complex engineering problems in biological manufacturing and processing process, and obtain valid conclusions.
<p>Requirement 3.</p> <p>Have the ability to comprehensively use the theoretical knowledge mastered to design solutions to complex engineering problems in the biological manufacturing and processing. Able to design systems, units or processes that meet specific needs, reflect the sense of innovation in the design process, and consider social, health, safety, legal, cultural and environmental factors in the design or development process.</p>	3-1. Master the basic design/development methods and techniques of the biological manufacturing and processing processes design and product development full cycle and entire process, understand the various factors that affect the design goals and technical solutions.
	3-2. Be able to complete unit designs for the specific needs of the biological manufacturing and processing processes.
	3-3. Be able to design systems or technological process for the specific needs of biological manufacturing and processing, and reflect the sense of innovation in the design process.
	3-4. Be able to consider social, health, safety, legal, cultural and environmental constraints in the process design and product development of biological manufacturing and processing.
<p>Requirement 4.</p> <p>Have the ability to research complex engineering scientific issues in the biological manufacturing and processing based on scientific principles and using scientific methods, including designing experiments, analyzing and interpreting data, and obtaining reasonable and effective conclusions through information synthesis.</p>	4-1. Be able to investigate and analyze solutions to complex engineering problems in biological manufacturing and processing based on scientific principles, through literature research or related methods.
	4-2. Be able to select appropriate technical routes and design experimental programs according to the characteristics of complex engineering problems in biological manufacturing, processing, etc.
	4-3. Be able to construct experimental systems according to the experimental plan, conduct experiments scientifically, rigorously and safely; be able to collect complete and reliable experimental data correctly.
	4-4. Be able to compare, summarize, analyze and interpret experimental results to get reasonable and effective conclusions.
<p>Requirement 5.</p> <p>Have the ability to develop, select and use appropriate techniques, resources, modern engineering tools and</p>	5-1. Be able to understand the principles and methods of using modern instruments, information technology tools, engineering tools and simulation software commonly used in bioengineering majors, and understand their limitations

information technology tools for complex bioengineering and related field problems, simulate and predict professional problems in the process of cell growth, biological reactions, ect., and understand their limitations.	5-2. Be able to select and use modern instruments, CAD, professional databases and simulation software, etc., to analyze, calculate and design complex engineering problems in the process of biological manufacturing and processing.
	5-3. Be able to develop, select and use appropriate modern analysis tools or software to simulate and predict professional problems in cell growth, biological reactions and separation, and be able to analyze their limitations.
Requirement 6. Familiar with the relevant policies and regulations of bioengineering and its industry, able to conduct reasonable analysis based on engineering-related background knowledge, and evaluate the impact of professional engineering practices and complex bioengineering problem solutions on society, health, safety, law, and culture, and understand the responsibilities that should be assumed.	6-1. Be familiar with the technical standard system, intellectual property rights, industrial policies and laws and regulations related to the biochemical and pharmaceutical industries, and understand the impact of different social cultures on engineering activities.
	6-2. Be able to analyze and evaluate the possible impact of existing bioengineering practices and complex bioengineering problem solutions on society, health, safety, law, and culture, as well as the impact of these constraints on project implementation, and understand the responsibilities that should be undertaken.
Requirement 7. Be able to understand and evaluate the impact of engineering practice aiming at complex engineering problems in the process of biological manufacturing and processing on environmental and social sustainable development.	7-1. Know and understand the concept and connotation of environmental protection and sustainable development, establish an awareness of environmental protection and sustainable development, and be able to understand and correctly assess the possible damage and potential hazards to humans and the environment throughout the production practices of bioengineering products.
	7-2. Be able to evaluate and consciously apply advanced technologies in engineering practice that are energy efficient and environmentally friendly and promote sustainable social development
Requirement 8. Have good humanities and social sciences, a sense of social responsibility, compliance with the law, integrity, and the ability to understand and comply with the code of ethics for the engineering profession and fulfil responsibilities in the practice of bioengineering.	8-1. Possess good moral qualities and humanities and social science literacy, establish and practise socialist core values, understand the relationship between the individual and society, understand China's national conditions, and clarify the responsibilities and missions of individuals as builders and successors of the socialist cause.
	8-2. Understand the professional engineering ethics, and the norm of honesty , fairness and integrity; be able to consciously follow them in the practice of bioengineering.
	8-3. Understand the social responsibility of bioengineers for public safety, health and well-being, as well as environmental protection, and be able to consciously fulfill their responsibilities in engineering practice.
Requirement 9. Have a strong sense of team and sound personality, and be able to take on the role of individual, team member and leader in a multidisciplinary team.	9-1. Understand the relationship between individuals and teams in a multidisciplinary context, have a good sense of teamwork and the ability to communicate effectively with members of other disciplines and to perform the tasks assigned to them individually.
	9-2. Be able to organize and coordinate the project team work tasks from a multidisciplinary background and organize their implementation.

<p>Requirement 10.</p> <p>Be able to effectively communicate with industry peers and the public on complex engineering problems in the process of biological manufacturing and processing, including writing reports and design manuscripts, making statements, clearly expressing or responding to instructions. An international outlook and contemporary awareness and a healthy sense of interpersonal communication and the ability to communicate and interact in a cross-cultural context.</p>	10-1. Be able to communicate and interact effectively with industry peers and the public by writing reports, design briefs and presentation speeches to clearly express ideas and respond to queries on complex engineering issues in biological manufacturing and processing.
	10-2. Understand the international development trends and research hotspots in the field of bioengineering and understand the differences and diversity between different cultures and technical behaviors.
	10-3. Have the verbal and written skills to communicate cross-culturally and be able to communicate in a basic manner in a cross-cultural context regarding professional issues in bioengineering.
<p>Requirement 11.</p> <p>Understand and master the principles of engineering management and economic decision-making methods, and be able to apply them in a multidisciplinary environment.</p>	11-1. Understand the management and economic decision making methods involved in bioengineering projects. Understand the cost components of the whole cycle and process of production of bioengineering products and understand the engineering management and economic decision making involved.
	11-2. Be able to integrate engineering management principles and economic decision-making methods in a multidisciplinary environment to solve complex engineering problems in biological manufacturing and processing.
<p>Requirement 12.</p> <p>Have the consciousness of self-learning and lifelong learning, have the ability of continuous learning and adapting to development.</p>	12-1. Be able to understand the new trend of bioengineering industry under the background of social development, and realize the necessity of autonomous and lifelong learning.
	12-2. Good independent learning skills, including the ability to analyze technical information, summarize and formulate questions, and the ability to adapt to the new demands of technological progress on professional competence.

### The relationship between graduation requirements and educational objectives

Graduation Requirements	Educational Objectives			
	Educational Objectives 1	Educational Objectives 2	Educational Objectives 3	Educational Objectives 4
1: Engineering Knowledge	√			
2: Problem Analysis	√	√		
3: Design/Development Solutions	√	√		
4: Research	√	√		
5: Use Modern Tools	√	√		
6: Engineering and Society		√		√
7: Environment and Sustainable Development		√		
8: Career Planning			√	√

9: Individuals and Teams			√	
10: Communicate			√	
11: Project Management		√		
12: Lifelong Learning	√	√	√	√

#### **IV. Major Subject**

Chemical engineering and technology

#### **V. Core Courses**

General Biology, Biochemistry, Cell Biology, Microbiology, Unit Operations of Chemical Engineering, Molecular Biology and Genetic Engineering, Microbial Engineering, Bioreaction Engineering, Bioseparation Engineering, Bioprocess Equipment.

#### **VI. Educational System**

The basic duration of the undergraduate programme is 4 years, with a flexible study period of 3-6 years, managed according to credit system.

#### **VII. Confer Degrees**

Students should complete at least 175 credits to graduate. Those who meet the conditions for the awarding of bachelor's degree in the Regulations on the Awarding of Bachelor's Degrees to Undergraduates of Shenyang University of Chemical Technology (Revised in March 2017) can be awarded a bachelor's degree in engineering.

## VIII. Credit Requirements

Course Type	Course Modules		Course Nature	Credit requirement	Subtotal	Proportion (%)
General Education	General Education (Compulsory)	Ideological and Political Courses	Compulsory	17	41	23.6
		Foreign Language Courses		12		
		Computer Courses		2		
		Military and Safety Courses		2		
		Labor and Sport Education		5		
		Innovation and Entrepreneurship		2		
		Mental Health		1		
	General Education (Optional)	Aesthetic Education(400)	Optional	2	8	4.6
		China and the World (500)		1		
		Four Histories(600)		1		
		Economic Management (700)		1		
		Science and technology (800)		1		
		Traditional Culture(900)		2		
General Education Practice	Military training		2	2	1.1	
Discipline Education	Basic Courses	Public basic class	Compulsory	79.5	70.5	70.7
		Professional Foundation				
	Basic Practice Sessions	-	Practice			
Specialized Education	Core Courses	-	Compulsory	14.5	42.5	
	Optional Courses	-	Optional	7		
	Specialized Practice Sessions	-	Practice	21		
Competency Development	Individualized Courses	-	Compulsory (or Practice)	10	10	
Extracurricular links	Extracurricular General Education Practice	Culture and Society Practice	Extracurricular Practice	4		
		Mentally and Physically Practice				
		Foreign Language Proficiency Training Practice				
	Extracurricular Characteristic Practice	Innovative Training		4		
		Innovation Competition				
		Chuangke activities				
	Career Education	Growth Planning Courses				1
Total/Proportion					174	100%

九、生物工程专业教学进程表

Table of Teaching Schedule for Bioengineering Major

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八		
											1st	2nd	3rd	4th	5th	6th	7th	8th		
通识教育课 General Education	思政类 Ideological and Political Courses		0710093001	思想道德与法治    Ideological Morality and the Rule of Law	3.0	48	32			16	2									
			0710053001	中国近现代史纲要   Outline of Chinese Contemporary and Modern History	3.0	48	32			16		2								
			0710103001	马克思主义基本原理*   Basic Principles of Marxism*	3.0	48	32			16			2							
			0710123001	习近平新时代中国特色社会主义思想概论   Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3.0	48	40			8				3						
			0710133001	毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3.0	48	32			16				2						
			0710012301	形势与政策   Current Situation and Policies	2.0	64	64						1	1	1	1	1	1	1	1
	外语类 Foreign Language Courses		0211003101	大学外语I   College English I	3.0	48					3									
			0211003201	大学外语II   College English II	3.0	48						3								
			0241003301	大学外语III   College English III	3.0	48	48							3						
				大学外语III（进阶英语）    College English III（Advanced English CET 6-Orientated）	3.0	48	48								3					

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八			
											1st	2nd	3rd	4th	5th	6th	7th	8th			
通识教育课 General Education	必修 Compulsory	外语类 Foreign Language Courses	0241003301	大学外语III（英语口语表达与交流）    College English III（English Oral Expression and Communication）	3.0	48	48						3						五选一		
				大学外语III（跨文化交际）    College English III（Intercultural Communication）	3.0	48	48								3						
				大学外语III（英语写作表达与交流）    College English III（English Writing Expression and Communication）	3.0	48	48									3					
			0241003401	大学外语IV*   College English IV*	3.0	48	48									3					
				大学外语IV（进阶英语）    College EnglishIV（Advanced English CET 6-Orientated）	3.0	48	48										3				
				大学外语IV（英语口语表达与交流）   College EnglishIV（English Oral Expression and Communication）	3.0	48	48										3				
				大学外语IV（跨文化交际）    College English IV（Intercultural Communication）	3.0	48	48											3			
				大学外语IV（英语写作表达与交流）    College English IV（English Writing Expression and Communication）	3.0	48	48													3	
				计算机类 Computer Courses	1613242001	大学计算机基础   Fundamentals of Computer	2.0	36	24			12		2							

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八	
											1st	2nd	3rd	4th	5th	6th	7th	8th	
通识教育课 General Education	军事安全类 Military and Safety Courses	0140011001	军事理论   Military Theory	1.0	16					2									
		1910011302	安全教育   Safety Education	1.0	16					1	1	1	1	1	1	1			
	劳动体育类 Labor and Sport Education	2640021001	劳动教育   Labour Education	1.0	16	16						2							
		0410011101	大学体育I   College Physical EducationI	1.0	36		36				2								
		0410021201	大学体育II   College Physical EducationII	1.0	36		36					2							
		0410031301	大学体育III   College Physical EducationIII	1.0	36		36						2						
		0410041401	大学体育 IV   CollegePhysical EducationIV	1.0	36		36							2					
		创新创业类 Innovation and Entrepreneurship courses	1920261002	创造性思维与创新方法   Creative Thinking and Innovative Methods	1.0	16	16							2					
	1740011001		创业基础   Entrepreneurial Foundation	1.0	16	16								2					
	心理健康类 Mental Health Courses	0510041001	大学生心理与健康教育   Mental and Health Education for College Students	1.0	16	16						2							
	小计 Subtotal				41	772	416	144	12	72									
	选修 Optional		分为经济管理类（1.0）、美育类（2.0）、科学技术类（1.0）、四史（1.0）、传统文化（2.0）、中国与世界（1.0）课程类6个模块 每个模块最多选修2.0学分，每学期最多选修2门课程。经济管理类课程限选《技术经济与工程项目管理》(7001700042，第5学期)。 Including 6 modules: Economic Management, Aesthetic Education , Science and Technology,Four Histories, Traditional Chinese Culture, China and The world. Up to2.0 credits per module and up to 2 courses per semester.Economic management courses are limited to 《Technology Economics and Project Management》(7001700042, The 5th semester)			8													
	实践 Practice		0415102011	军训   military training	2.0	48				48	+2								



课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes					
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八						
											1st	2nd	3rd	4th	5th	6th	7th	8th						
合计 Total					51																			
学科平台课 Discipline Education	必修 Compulsory		数学与自然科学类 Natural Science & Mathematics	0310004101	高等数学 I*   Advanced Mathematics I*	4.5	80	72			8	6												
				0310005201	高等数学 II*   Advanced Mathematics II*	5.5	96	88			8	6												
				0310032001	线性代数    Linear Algebra	2.0	32	32					2											
				0310042001	概率论与数理统计   Probability and Statistics	2.0	32	32						2										
				0310063101	大学物理 I*   University Physics I*	3.0	48	46	2				3											
				0310063201	大学物理 II*   University Physics II*	3.0	48	46	2					3										
				0319022001	无机化学 B*   Inorganic Chemistry B*	2.0	32	32					2											
				0319042001	分析化学 A*   Analytical Chemistry A*	2.0	32	32							2									
				0319072001	有机化学 D*    Organic Chemistry D*	2.5	40	40						3										
				0319123001	物理化学*   Physical Chemistry *	3.0	48	48							3									
	工程基础类 Foundation Engineering			1912411002	生物工程导论   Introduction to Bioengineering	1	16	16				2									CDIO 课程			
				1510122001	电工学   Electrical Engineering	2.5	44	32	12					3										
				2118004001	工程制图及 CAD    Engineering Drawing & CAD	4.0	68	56		12					4									

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes			
							讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八				
											1st	2nd	3rd	4th	5th	6th	7th	8th				
学科平台课 Discipline Education	工程基础类 Foundation Engineering	2110111001	过程装备机械设计基础   Mechanical design basis of process equipment	1	16	16							2									
		1110014001	化工原理*   Unit Operations of Chemical Engineering*	4.0	64	64								4								
	必修 Compulsory	专业基础类 Specialised Foundation Requisite	1912022002	普通生物学   General Biology	2	32	32						2									
			1912034002	生物化学*   Biochemistry	4	64	64							4								
			1912082002	细胞生物学   Cell Biology	2	32	32							2								
			1912043002	微生物学*   Microbiology	3	48	48								3							
			1912051002	生物工程仪器分析   Bioengineering Instrumental Analysis	1.5	24	24									2						
			1912061002	生物工程专业外语   Professional English for Biological Engineering	1	24	16				8							2				
			1912071002	科技外语写作与文献检索   Writing of Scientific English and Literature Searching	1	16	16													2		
			1912221002	生物安全与环保   Biosafety and Environmental Protection	1	16	16														2	
			1912291002	生物制品质量管理   Quality Management of Biological Products	1	16	16															2
			小计 Subtotal				58.5	968	916	16	12	24										
	实践 Practice		0310081011	大学物理实验   Physical Experiment of College	1.0	24	6	18				3										
			0311061111	无机化学实验 I   Inorganic Chemistry Experiment I	1.0	24		24				4										

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes	
						讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一	二	三	四	五	六	七	八		
										1st	2nd	3rd	4th	5th	6th	7th	8th		
学科平台课 Discipline Education	实践 Practice	0313141011	分析化学实验    Experiments in Analytical Chemistry	1.0	24		24					4							
		0312081011	有机化学实验 A    Organic Chemistry Experiment A	1.5	36	0	36				6								
		0319221011	物理化学实验 A    Experiments in Physical Chemistry A	1.5	36	4	32						4						
		2110021021	过程装备机械设计基础课程设计    Course Design of Mechanical Design Basis of Process Equipment	1.0	24		24							+1					
		1110041011	化工原理实验    Experiment for Unit Operations of Chemical Engineering	1.0	24		24								1				
		1110032021	化工原理课程设计    Curriculum Project for Unit Operations of Chemical Engineering	2.0												+2			
		2110072031	金工实习    Metalworking Practice	2.0								+2							
		小计 Subtotal			12	192	10	182											
合计 Total			70.5																
专业教育课 Specialized Education	必修 Compulsory	1912143002	分子生物学与基因工程*    Molecular Biology and Gene Engineering	3	48	48								3					
		1912172002	生物反应工程    Bioreaction Engineering	2	32	32										3			
		1912422002	微生物工程*    Microbial Engineering	2	32	32											3		
		1912432002	生物分离工程*    Bioreaction Engineering	2	32	32												3	

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
						讲课 Lec.	实验 Exp.	上机 Pro.	课外实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th			
专业教育课 Specialized Education	必修 Compulsory	1912202002	生物工程设备*   Bioprocess Equipment	2	32	32									3			CDIO 课程		
		1912212002	生物工程工厂设计概论   Conspectus of Biological Plant Design	2	32	32											3		CDIO 课程	
		1912281002	计算机在生物工程中的应用   Computer Applications in Bioengineering	1.5	28	16			12									2		
		小计 Subtotal			14.5	236	224			12										
	选修 Optional	1932091002	生物统计学   Biostatistics	1.5	24	24									2					
		1932102002	遗传学   Genetics	2	32	32									3					
		1932112002	免疫学   Immunology	2	32	32									3					
		1932152002	细胞工程   Cell Engineering	2	32	32									2					
		1932132002	天然药物化学   Medicinal Chemistry of Natural Products	2	32	32									2					
		1932242002	生物制药   Biotechnological Pharmaceutics	2	32	32										3				
		1932122002	药理学   Pharmacology	2	32	32										3				
		1932162002	酶工程   Enzyme Engineering	2	32	32										3				
		1932252002	工业微生物育种学    Breeding technology of Industrial Microorganisms	2	32	32										3				
1932261002	工业发酵调控学   Concepts of Industrial Fermentation	1.5	24	24												2				

课程类别 Course Type	课程性质 Course Nature	课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes		
						讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一	二	三	四	五	六	七	八			
										1st	2nd	3rd	4th	5th	6th	7th	8th			
专业教育课 Specialized Education	选修 Optional	1932232002	生物制药工艺学   Biopharmaceutical Process	2	32	32											3			
		1932272002	生物工程产品工艺学  Production technology of Bioengineering products	2	32	32												3		
		1932301002	代谢工程   Metabolic Engineering	1	16	16													2	
		1932311002	生物炼制工程   Biorefinery Engineering	1	16	16													2	
		小计 Subtotal		7																
	(专业教育课选修课程学分要求≥7学分; The credit requirement of the optional specialized education courses shall be ≥7 credits)																			
	实践 Practice	1912512012	生物化学实验   Biochemistry Experiments	2	48								4							
		1912322012	微生物学实验   Microbiology Experiment	2	48									4						
		1912331032	认识实习   Cognition practice	1												+1				
		1912342032	生产实习   Production Practice	2													+2			
		1912391042	毕业设计(论文)   Graduation Design (Thesis)	14															+14	
小计 Subtotal		21																		
合计 Total				42.5																
能力拓展课 Competency Development	必修或实践 Compulsory or Practice	1912351022	生物工程课程设计   Curriculum Design of Bioengineering	1													+1			
		1912444112	生物工程专业实验I   Specialty Experiment(I) of Bioengineering	4.5	108										4.5					

课程类别 Course Type	课程性质 Course Nature		课程号 Course Code	课程名称 Course Name	学分 Cre.	总学 时数 T.C.H	学时分配 Credit Hour Distribution				各学期周学时分配 Weekly Hours Per Semester								备注 Notes
							讲课 Lec.	实验 Exp.	上机 Pro.	课外 实践 Pra.	一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th	
能力拓展课 Competency Development	必修或实践 Compulsory or Practice		1912444212	生物工程专业实验II   Specialty Experiment (II) of Bioengineering	4.5	108											4.5		
			小计 Subtotal				10												
			(必须修读所有能力拓展课程) (All the Competency Development Courses are required to be taken.)																
总计 Sum					174.0						19.5	22.5	25.5	27.5	18.5	24.5	20	17	
课外环节 Extracurricular links	课外实践 Extracurricular practice		人文社会实践 Culture and Society Practice	1910501012	社会调查   Social Survey	0.5	12				12							0.5	
				0410050751	课外体育锻炼   Extracurricular Physical Exercise	0.5	12				12								0.5
			身心健康社会实践 Mentally and Physically Practice	2640030011	劳动教育实践   Labour Education Practice	0.5	12				12	0.5							
				0510070311	心理健康辅导   Mental Health Counseling	0.5	12				12								0.5
			外语技能实践类 Foreign Language Proficiency Training Practice	0210010011	外语技能实践(初级)   Foreign Language Proficiency Training Practice (elementary)	2.0	48				48			2					
				0210020011	外语技能实践(高级)   Foreign Language Proficiency Training Practice (advanced)	2.0	48				48			2					
			能力与创新实践 Capability and Innovation Practice	1910014852	大学生素质拓展与创新实践   Quality Development and Innovation Practice	4.0	96				96	1~8 学期依据《沈阳化工大学创新创业实践学分认定办法》由创新创业学院认定							
			成长规划类 Growth Planning Courses	1910561012	职业规划与就业指导   Career Planning and Employment Guidance	1.0	40	40				1						1	
小计 Subtotal																			

理论课 1 学分 16 学时，实验课程、上机等 1 学分 24 学时，体育课 1 学分 36 学时，集中实践环节 1 个教学周计 1 学分，学分最小单位为 0.5,课程名称中画\*为考试课。

Note: "Cre. (Credits)", "T.C.H. (Total Credit Hours)", "Lec. (Lecture)", "Exp. (Experiment)", "Pro. (Programming)", "Pra. (Practice)".

## 十、生物工程专业学士学位课程一览表

### A list of bachelor's degree programs in Bioengineering Major

课程类别 Course Type	模块名称 Modules	序号 No	课程编号 Course Codes	课程名称 Course Name	学分 Credits	开课学期 Semester	
通识教育课 General Education	政治理论 Political Theory	1	0710103001	马克思主义基本原理*   Basic Principles of Marxism*	3	3	
		2	0710133001	毛泽东思想和中国特色社会主义理论体系概论*   Mao Zedong Thought and Theory of Socialism with Chinese Characteristics*	3	4	
学科平台课 Discipline Education	数学 Mathematics	3	0310004101	高等数学I* Advanced Mathematics I*	4.5	1	
		4	0310005201	高等数学II* Advanced Mathematics II*	5.5	2	
	物理 Physics	5	0310063101	大学物理I University Physics I	3	2	
		6	0310063201	大学物理II* University Physics II*	3	3	
	化学基础 Foundations of Chemistry	7	0319022001	无机化学 B*   Inorganic Chemistry B*	2	1	
		8	0319042001	分析化学 A*   Analytical Chemistry A*	2	3	
		9	0319072001	有机化学 D*    Organic Chemistry D*	2.5	2	
		10	0319123001	物理化学*   Physical Chemistry *	3	3	
	专业基础 Specialised Foundation Requisite	11	1110014001	化工原理*   Unit Operations of Chemical Engineering*	4	5	
		12	1912034002	生物化学*   Biochemistry	4	4	
		13	1911043002	微生物学*   Microbiology	3	5	
	专业教育课 Specialized Education	必修 Compulsory	14	1912143002	分子生物学与基因工程*   Molecular Biology and Gene Engineering	3	5
			15	1912422002	微生物工程*   Microbial Engineering	2	6
16			1912432002	生物分离工程*   Bioseparation Engineering	2	6	
17			1912202002	生物工程设备*   Bioprocess Equipment	2	6	

说明：关于学士学位课的具体要求见《沈阳化工大学关于学士学位课程水平审核制度的若干规定》

### 十一、全学程实践环节周历安排 Weekly Calendar of all Practice Sessions

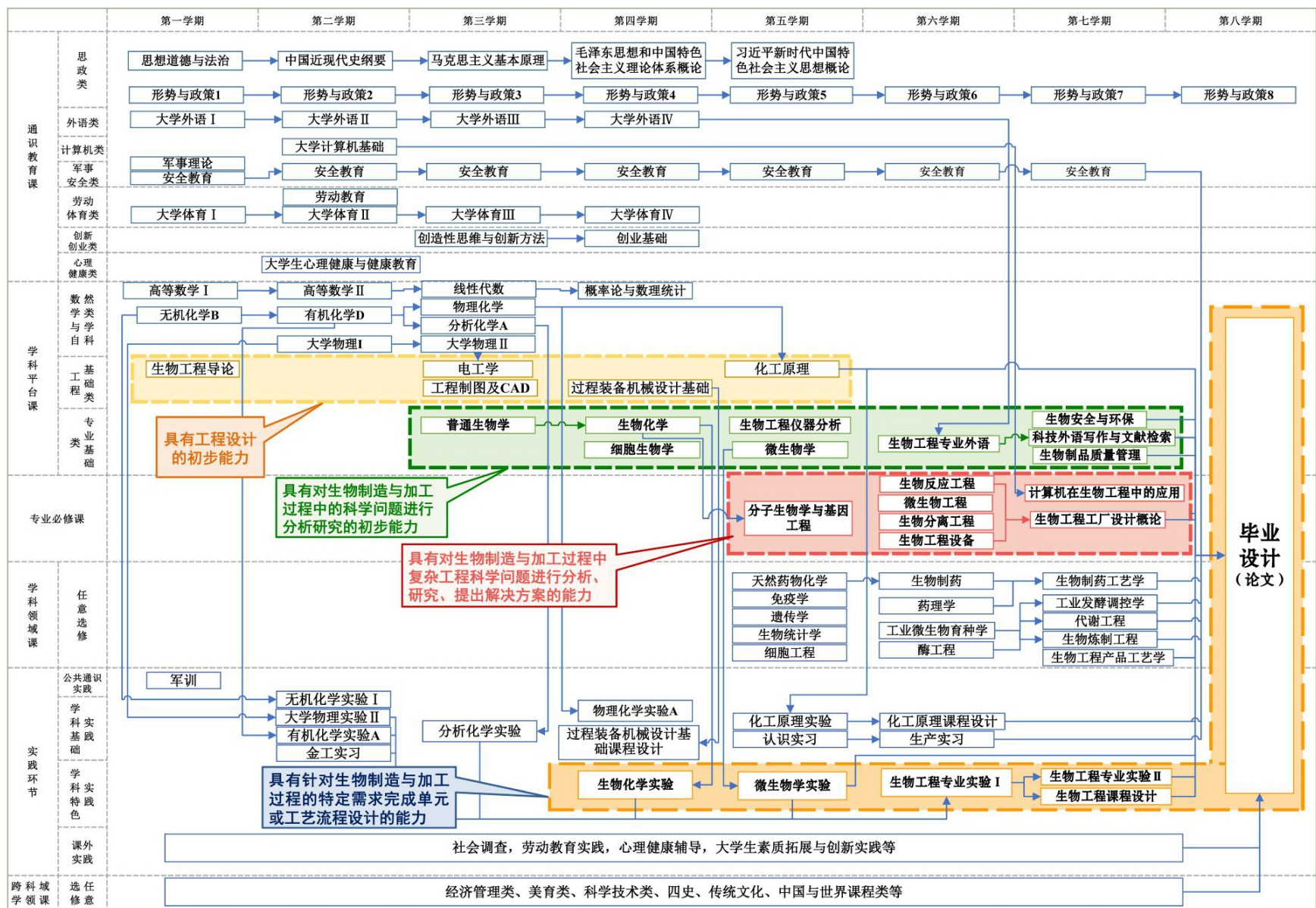
学期	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	备注	
一		☆	☆															::	::	·			
二							※	※											::	::	·		
三																			::	::	·		
四																			::	::	·		
五	▼																		::	::	·		
六													/	/					::	::	·		
七															△				::	::	·		
八	=	=	=	=	=	=	=	=	=	=	=	=	=	=									

符号说明(Symbol Description):

※金工实习||Metalworking Practice    △课程设计||Curriculum Design    /生产实习||Specialized Production Practice    L 专业实验||Specialty Experiment    P 各类实训、学年论文||Practical Training、Term Paper    :: 考试||Examination    ▼ 认识实习||Cognition Practice    ☆军训||Military Training    = 毕业设计(论文)||Graduation Project(Thesis)    ·小学期||Primary Term



## 十二、课程体系配置图 Curriculum System Configuration Diagram



十三、主要课程与毕业能力要求关系矩阵图(相关性强 H,相关性中 M, 相关性弱 L)

**Correlation Matrix between Key Courses and Graduation Requirements (High Correlation—H, Medium Correlation—M, Low Correlation—L)**

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																		
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	11.1	11.2	12.1	12.2	
思想道德与法治    Ideological Morality and the Rule of Law																								H	M	M									
中国近现代史纲要    Outline of Chinese Contemporary and Modern History																								M											
马克思主义基本原理*    Basic Principles of Marxism*																								M											
习近平新时代中国特色社会主义思想概论    Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era																						H		H	H	M									
毛泽东思想和中国特色社会主义理论体系概论    Mao Zedong Thought and Theory of Socialism with Chinese Characteristics																								H											
形势与政策    Current Situation and Policies																								M						M					
军事理论    Military Theory																								M											
安全教育    Safety Education																					M		M		M										
劳动教育    Labour Education																								M		M		M							



课程 (Courses)	毕业能力要求 (Graduation Requirements)																																			
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	11.1	11.2	12.1	12.2		
无机化学 B*   Inorganic Chemistry B*	H				M																															
分析化学 A*   Analytical Chemistry A*					H																															
有机化学 D*   Organic Chemistry D*	H				M																															
物理化学*   Physical Chemistry *		M			M	H																														
生物工程导论   Introduction to Bioengineering																			M						M				M					H		
电工学   Electrical Engineering			M			M																														
工程制图及 CAD   Engineering Drawing & CAD					M				M									H											L							
过程装备机械设计基础   Mechanical Design Basis of Process Equipment				L			L	M																												
化工原理*   Unit Operations of Chemical Engineering*			H			H		H																												
普通生物学   General Biology	M																					H														
生物化学*   Biochemistry			M		H							H																								
细胞生物学   Cell Biology			M		H							H																								
微生物学*   Microbiology					H							H											L													
生物工程仪器分析   Bioengineering Instrumental Analysis																H	M																			
生物工程专业外语   Professional English for Biological Engineering																																	M	H		

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																			
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	11.1	11.2	12.1	12.2		
科技外语写作与文献检索   Writing of Scientific English and Literature Searching							M																									M				M
生物安全与环保   Biosafety and Environmental Protection											H										H	H				H										
生物制品质量管理   Quality Management of Biological Products											H								H													M				
分子生物学与基因工程*   Molecular Biology and Gene Engineering							M			H			H																							
生物反应工程   Bioreaction engineering		H				H			L																											
微生物工程*   Microbial Engineering				H			H	M					M																							
生物分离工程*   Bioseparation Engineering				M			H			M			H																							
生物工程设备*   Bioprocess Equipment				H					L		H																									
生物工程工厂设计概论   Conspectus of Biological Plant Design								H		M										L													M			
计算机在生物工程中的应用   Computer Applications in Bioengineering															H	M		H																		
大学物理实验 II   Physical Experiment of CollegeII														H	M	M																				
无机化学实验 I   Inorganic Chemistry Experiment I														H	M			M																		
分析化学实验    Experiments in Analytical Chemistry														H	M			M																		

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																		
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	11.1	11.2	12.1	12.2	
有机化学实验 A    Organic Chemistry Experiment A														H	M			M																	
物理化学实验 A    Experiments in Physical Chemistry A														H	M			M																	
过程装备机械设计基础课程设计    Course Design of Mechanical Design Basis of Process Equipment											M																								
化工原理实验    Experiment for Unit Operations of Chemical Engineering															M																				
化工原理课程设计    Curriculum project for Unit Operations of Chemical Engineering											H							M									H								
金工实习    Metalworking Practice											M															L		M							
生物化学实验    Biochemistry Experiments										M					H																				
微生物学实验    Microbiology Experiment										M					H																				
认识实习    Cognition practice																				M		M						M							L
生产实习    Production Practice												M									M					H					M				
生物工程课程设计    Curriculum design of Bioengineering												H						H																M	
生物工程专业实验I    Specialty Experiment(I) of Bioengineering																M			M										M	M					
生物工程专业实验II    Specialty Experiment (II) of Bioengineering															H			H								M		M	M						

课程 (Courses)	毕业能力要求 (Graduation Requirements)																																				
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	5.1	5.2	5.3	6.1	6.2	7.1	7.2	8.1	8.2	8.3	9.1	9.2	10.1	10.2	10.3	11.1	11.2	12.1	12.2			
毕业设计 (论文)   Graduation Design (Thesis)											M							M		H		H						H								H	
大学生素质拓展与创新实践   Quality Development and Innovation Practice																											H		H			M	M				
职业规划与就业指导   Career Planning and Employment Guidance																									H												H