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工程教育认证标准

Engineering education accreditation criteria

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前　言

本文件按照 GB/T 1.1—2020《标准化工作导则　第 1 部分：标准化文件的结构和起草规则》的规定起草。

请注意本文件的某些内容可能涉及专利。本文件的发布机构不承担识别专利的责任。

本文件由中国工程教育专业认证协会和教育部教育质量评估中心提出并归口。

本文件起草单位：中国工程教育专业认证协会、教育部教育质量评估中心、中国标准化协会、中国测绘学会、中国地质学会、中国电工技术学会、中国电机工程学会、中国兵工学会、中国电力企业联合会、中国电子学会、中国纺织工业联合会、中国复合材料学会、中国钢铁工业协会、中国高等教育学会、中国光学光电子行业协会、中国航空学会、中国核能行业协会、中国核学会、中国环境保护产业协会、中国环境科学学会、中国机械工程学会、中国机械工业联合会、中国建筑学会、中国建筑材料联合会、中国交通教育研究会、中国交通运输协会、中国金属学会、中国建设教育协会、中国矿业联合会、中国煤炭工业协会、中国农业工程学会、中国汽车工程学会、中国轻工业联合会、中国软件行业协会、中国石油和化学工业联合会、中国食品科学技术学会、中国水利学会、中国铁道学会、中国通信学会、中国土木工程学会、中国仪器仪表学会、中国有色金属工业协会、中国造船工程学会、中国职业安全健康协会、中国自动化学会、中国科协培训和人才服务中心、中国公路学会、联合国教科文组织高等教育创新中心（中国深圳）、中国纺织工程学会、河南省教育评估中心、广东省工程师学会、上海市工程师学会、江苏省工程师学会、江苏省教育评估院、黑龙江教师发展学院（黑龙江省教育评估院）、北京工程师学会、重庆市工程师协会、山东省工程师协会。

本文件主要起草人：范唯、周爱军、顾佩华、陈道蓄、王孙禺、王志华、王玲、乐清华、吕志伟、刘志军、李志义、李茂国、陈以一、雷庆、王天羿、孙谊、孟玉婵、戴先中、郑璇、赵自强、孙颖、贾茜、李涛、刘晶。

引　言

工程教育认证是国际通行的工程教育质量保证制度，也是实现工程教育国际互认和工程师资格国际互认的重要基础。我国的工程教育认证工作开始于2006年，是工程师制度改革工作的基础和重要组成部分。2016年，我国加入《华盛顿协议》成为正式成员。

开展工程教育认证的目标是：推动中国工程教育的质量保障体系持续完善，推进中国工程教育改革，进一步提高工程教育质量；建立与工程师制度相衔接的工程教育认证体系，促进教育界与企业界的联系，增强工程教育人才培养对产业发展的适应性；促进中国工程教育的国际互认。

中国工程教育专业认证协会是由热心中国工程教育的有关团体和个人自愿结成的全国性、非营利性、会员制社会团体组织（以下简称“认证协会”）。

开展认证以来，认证协会会同有关单位，根据我国工程教育的实际情况，参考国际工程教育界通行标准与做法，按照实质等效的原则，研究制定了《工程教育认证标准》，以认证协会内部印发文件的形式执行。为适应新形势下教育评价工作的有关要求，进一步规范工程教育认证工作，促进国际交流互认，根据认证协会理事会决议，在原《工程教育认证标准》基础上，保持核心内容不变，修改形成了本文件。

根据认证工作开展情况和专业领域拓展情况，认证协会将不断修订完善本文件。

本文件核心内容已执行多年，经历了多次修订和迭代，参与该项工作的领导、专家和工作人员众多，限于篇幅，无法在本文件主要起草人中一一列举，在此一并表示感谢。

本文件在执行过程中的意见或建议反馈至中国工程教育专业认证协会秘书处（地址：北京市海淀区学院路30号，邮编：100083，邮箱：ceeaa@cast.org.cn）。

工程教育认证标准

1 范围

本文件规定了工程教育认证的通用标准和各专业类补充标准。

本文件适用于以培养工程师为目标的普通高等学校全日制普通四年制本科专业工程教育认证。

2 规范性引用文件

本文件没有规范性引用文件。

3 术语和定义

下列术语和定义适用于本文件。

3.1

培养目标 educational objectives

对学生在毕业后5年能够达到的职业和专业成就的总体描述。

3.2

毕业要求 graduate outcomes

对学生毕业时应该掌握的知识和能力的具体描述。

注：包括学生通过本专业学习所掌握的知识、技能和素养。

3.3

评估 assessment

确定、收集和准备各类文件、数据和证据材料，以便对课程教学、学

生培养、毕业要求、培养目标等进行评价的工作。

注：可采用合理的抽样方法，恰当使用直接的、间接的、量化的、非量化的手段，进行有效的评估。

3.4

评价 evaluation

对评估过程中所收集到的资料和证据进行解释的过程。

注：评价结果是提出相应改进措施的依据。

3.5

机制 mechanism

针对特定目的而制定的一套规范的处理流程。

注：包括目的、相关规定、责任人员、方法和流程等，对流程涉及的相关人员的角色和责任有明确的定义。

3.6

复杂工程问题 complex engineering problem

必须运用深入的工程原理，经过分析才能得到解决的问题。

注：同时具备下述特征的部分或全部：

a） 涉及多方面的技术、工程和其他因素，并可能相互有一定冲突；
b） 需要通过建立合适的抽象模型才能解决，在建模过程中需要体现出创造性；
c） 不是仅靠常用方法就可以完全解决的；
d） 问题中涉及的因素可能没有完全包含在专业工程实践的标准和规范中；
e） 问题相关各方利益不完全一致；
f） 具有较高的综合性，包含多个相互关联的子问题。

4 通用标准

4.1 学生

该项应包括：

a） 具有吸引优秀生源的制度和措施；
b） 具有完善的学生学习指导、职业规划、就业指导、心理辅导等方面的措施并能够很好地执行落实；

c) 对学生在整个学习过程中的表现进行跟踪与评估，并通过形成性评价保证学生毕业时达到毕业要求；

d) 有明确的规定和相应认定过程，认可转专业、转学学生的原有学分。

4.2 培养目标

该项应包括：

a) 有公开、符合学校定位、适应社会经济发展需要的培养目标；

b) 定期评价培养目标的合理性并根据评价结果对培养目标进行修订，评价与修订过程有行业或企业专家参与。

4.3 毕业要求

专业应有明确、公开、可衡量的毕业要求，毕业要求应支撑培养目标的达成。专业制定的毕业要求应完全覆盖以下内容：

a) 工程知识：能够将数学、自然科学、工程基础和专业知识用于解决复杂工程问题；

b) 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复杂工程问题，以获得有效结论；

c) 设计/开发解决方案：能够设计针对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；

d) 研究：能够基于科学原理并采用科学方法对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；

e) 使用现代工具：能够针对复杂工程问题，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；

f) 工程与社会：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;

g) 环境和可持续发展:能够理解和评价针对复杂工程问题的工程实践对环境、社会可持续发展的影响;

h) 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;

i) 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;

j) 沟通:能够就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;

k) 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;

l) 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。

4.4 持续改进

该项应包括:

a) 建立教学过程质量监控机制,各主要教学环节有明确的质量要求,定期开展课程体系和课程质量评价;建立毕业要求达成情况评价机制,定期开展毕业要求达成情况评价;

b) 建立毕业生跟踪反馈机制以及有高等教育系统以外有关各方参与的社会评价机制,对培养目标的达成情况进行定期分析;

c) 能证明评价的结果被用于专业的持续改进。

4.5 课程体系

课程设置应支持毕业要求的达成,课程体系设计有企业或行业专家参与。课程体系应包括:

a) 与本专业毕业要求相适应的数学与自然科学类课程(至少占

总学分的15%)；

b) 符合本专业毕业要求的工程基础类课程、专业基础类课程与专业类课程(至少占总学分的30%)；工程基础类课程和专业基础类课程能体现数学和自然科学在本专业应用能力的培养，专业类课程能体现系统设计和实现能力的培养；

c) 工程实践与毕业设计(论文)(至少占总学分的20%)；设置完善的实践教学体系，并与企业合作，开展实习、实训，培养学生的实践能力和创新能力；毕业设计(论文)选题结合本专业的工程实际问题，培养学生的工程意识、协作精神以及综合应用所学知识解决实际问题的能力；对毕业设计(论文)的指导和考核有企业或行业专家参与；

d) 人文社会科学类通识教育课程(至少占总学分的15%)，使学生在从事工程设计时能够考虑经济、环境、法律、伦理等各种制约因素。

4.6 师资队伍

该项应包括：

a) 教师数量能满足教学需要，结构合理，并有企业或行业专家作为兼职教师；

b) 教师具有足够的教学能力、专业水平、工程经验、沟通能力、职业发展能力，并且能够开展工程实践问题研究，参与学术交流；教师的工程背景能满足专业教学的需要；

c) 教师有足够的时间和精力投入本科教学和学生指导中，并积极参与教学研究与改革；

d) 教师为学生提供指导、咨询、服务，并对学生职业生涯规划及职业从业教育有足够的指导；

e) 教师明确他们在教学质量提升过程中的责任，不断改进工作。

4.7 支持条件

该项应包括：

a） 教室、实验室及设备在数量和功能上满足教学需要；有良好的管理、维护和更新机制，使得学生能够方便地使用；与企业合作共建实习和实训基地，在教学过程中为学生提供参与工程实践的平台；

b） 计算机、网络以及图书资料资源能够满足学生的学习以及教师的日常教学和科研所需；资源管理规范、共享程度高；

c） 教学经费有保证，总量能满足教学需要；

d） 学校能够有效地支持教师队伍建设，吸引与稳定合格的教师，并支持教师本身的专业发展，包括对青年教师的指导和培养；

e） 学校能够提供达成毕业要求所必需的基础设施，包括为学生的实践活动、创新活动提供有效支持；

f） 学校的教学管理与服务规范，能有效地支持专业毕业要求的达成。

5 专业补充标准

5.1 注意事项

专业补充标准不应单独使用，开展认证时，专业应同时满足本文件规定的通用标准和相应专业领域的补充标准。

5.2 机械类专业

5.2.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的机械类专业。

5.2.2 课程体系

课程设置应包含自然科学类课程、工程基础类课程和实践环节，并应满足：

a） 自然科学类课程包含物理、化学（或生命科学）等知识领域；

b） 工程基础类课程包含工程图学、理论力学、材料力学、热流体、

电工电子、工程材料等知识领域；

c） 实践环节包括工程训练、课程实验、课程设计、企业实习、科技创新等，毕业设计（论文）以工程设计为主。

5.2.3 师资队伍

从事专业主干课程教学的教师，应具有企业工作经验或从事过工程设计和研究的工程背景，了解本专业领域科学和技术的最新发展。

5.3 计算机类专业

5.3.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的计算机科学与技术、软件工程等计算机类专业。

5.3.2 课程体系

课程设置应满足：

a） 支持学生掌握计算与计算系统抽象以及自动计算特征相关的基本知识，包括离散结构、程序设计、数据结构、计算机算法、计算机组成、操作系统、计算机网络、软件开发过程、数据管理与应用等领域的核心概念、基本原理，以及相关基本技术和方法；

b） 培养学生计算思维、基本算法、程序设计和系统能力，并能运用这些知识设计、实现或者部署复杂计算系统；

c） 保证学生受到足够的训练，包括课程作业与专业实践环节；

d） 专业课程，特别是基础类课程应有数量和难度与培养学生解决复杂工程问题能力相适应的作业；

e） 专业实践环节至少包含：

- 两个基于多门课程综合、具有一定规模的系统设计与开发；
- 毕业设计（论文）（至少占总学分的 8%，或不少于 14 周），

选题应有明确的应用背景，能体现学生系统实现的综合能力培养。

5.3.3 师资队伍

大部分授课教师在其学习经历中至少有一个阶段是计算机类专业学历。

5.4 化工与制药类、生物工程类及相关专业

5.4.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的化工与制药类、生物工程类以及应用化学、生物技术、生物信息学、石油工程、油气储运工程、海洋油气工程等专业。

5.4.2 课程体系

课程设置应满足：

a） 学生在毕业时能运用数学（含高等数学、线性代数等）、自然科学（含化学、物理、生物等）、工程科学原理（含信息、机械、控制）和实验方法，表达和分析化学、物理和生物过程中的复杂工程问题；

b） 学生能研究、模拟和设计化学、物理和生物过程，具有系统优化的知识和能力；

c） 学生能理解和分析在化学、物理和生物过程中存在的健康、安全与环境（HSE）风险和危害，了解现代企业 HSE 管理体系。

5.4.3 师资队伍

该项应包括：

a） 从事专业教学工作的 80％以上的教师，至少有 6 个月以上的企业工程实践经历；

b） 讲授安全、环保、工程设计等课程的教师具有与之相关的工程实践经验。

5.5 水利类专业

5.5.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的水利类专业以及农业工程类的农业水利工程专业。

5.5.2 课程体系

课程设置应满足：

a） 符合工程逻辑，涵盖解决水利勘测、规划、设计、实施、管理、维护等全周期、全流程过程中复杂工程问题的知识、能力和素质培养，使学生能够考虑各种制约因素解决工程技术问题；

b） 具有生态、环境的基础知识和水利工程生态、环境的专门知识，能分析、评价水利复杂工程问题解决方案对生态、环境的影响，并能考虑生态、环境的制约因素；

c） 工程实践各环节注重工程能力的培养：

- 课程实验有综合实验项目；
- 实习包含对水利工程问题复杂性的了解；
- 课程设计不少于 4 个，其中专业类课程设计不少于 2 个；
- 做毕业论文的学生，至少有一门专业类课程设计能使其得到解决复杂工程问题的训练；
- 毕业设计（论文）的时间不少于 12 周，包括对所涉及的经济决策、生态环境影响的理解与评价。

5.5.3 师资队伍

该项应包括：

a） 40％以上承担专业基础类、专业类课程教学的教师具有高级职称；聘请企业或行业专家为兼职教师承担培养方案中一定

的教学任务;

b) 专业类课程教师一般至少有一个本专业领域的学历,主讲教师具有本专业或相近专业领域的科研方向与经历;

c) 85%以上专业类课程教师具有本专业领域工程实践的经历,15%以上具有在水利企事业单位或相近单位累计参加工程实践半年以上的经历;

d) 具有发展青年教师工程能力、知识融合能力、教学能力的培养计划。

5.6 环境科学与工程类专业

5.6.1 适用专业领域

按照教育部规定设立的,授予工学学士学位的环境科学与工程类专业。

5.6.2 课程体系

课程设置应满足:

a) 学生在毕业时能运用数学(含高等数学、线性代数、概率论及数理统计等)、自然科学(含化学、物理、生物等)、工程科学原理和实验方法、专业知识(含水气固等污染防治与资源化利用、生态修复等)和经济决策、工程管理等知识以及现代工具;

b) 掌握工程相关的安全、健康、环境可持续发展等知识,具备开展生态与环境保护、污染防治的识别、表达、规划、管理、模拟、分析、评价、研究、开发、设计与优化的能力,能分析、评价、控制工程项目对社会、健康、安全和环境的影响,理解应承担的社会责任;

c) 在实践教学环节中受到足够的专业实践训练。

5.6.3 师资队伍

该项应包括:

a） 讲授专业课程的教师原则上应具有本专业的学习经历；

b） 从事专业教学工作的教师有6个月以上的相关工程实践经历。

5.7 安全科学与工程类专业

5.7.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的安全科学与工程类专业。

5.7.2 课程体系

课程体系设置应确保学生在毕业时：

a） 能运用数学、自然科学、工程科学、管理科学知识和实验手段识别危险源；

b） 能为降低风险而分析、设计、研究、表达和优化解决方案；

c） 能实施设计方案并评价实施绩效。

5.7.3 师资队伍

从事专业教学工作的教师，在其学习经历中至少有一个阶段是安全科学与工程类专业学历，或者具有两年以上本专业类的教育培训、科学研究、工程或管理实践等工作背景。

5.8 电子信息与电气工程类专业

5.8.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的电气类、电子信息类与自动化类专业。

5.8.2 课程体系

课程设置应满足：

a） 提供与专业名称相符的，具有相应的广度和深度的现代工程

内容；

b） 覆盖数学、自然科学（物理学，也可以包括化学、生命科学、地球科学和空间科学等）等知识领域及其应用，以及分析和设计与专业名称相符的复杂对象（包括硬件、软件和由硬件及软件组成的系统）所必需的现代工程内容；

c） 各专业分别涵盖以下知识领域：

- 电气类专业包括电磁理论、能量转换原理等核心知识领域，能够支撑在电气工程（包括电能生产、传输、应用等）中的认知识别、规划设计、运行控制、分析计算、实验测试、仿真模拟等能力的培养；
- 电子信息类专业包括物理机制、电子线路、信号/信息的获取与处理、信息计算与存储、通信传输、网络互联、移动应用等核心知识领域，能够支撑在电子、信息以及通信工程（包括电子、光子、信息等）中相应的材料、元器件、电路、信号、信息、网络及应用等分析与设计能力的培养；
- 自动化类专业包括建模、检测、控制、系统集成与应用技术等核心知识领域，能够支撑在现代自动化工程中的系统建模、检测与识别、信息处理与分析、自动控制、优化决策、系统集成以及人工智能应用等能力的培养；
- 未来特设专业的课程可选择相近专业的核心知识领域或者根据专业特色进行设置。

5.8.3 师资队伍

该项应包括：

a） 讲授专业核心课程的教师了解相应专业领域及其工程实践的最新进展；

b） 讲授主要设计类课程的教师具有足够的教育背景和设计经验，且这些设计类课程的教学不能仅依赖于某一位教师。

5.9 交通运输类专业

5.9.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的交通运输类专业。

5.9.2 课程体系

课程设置应满足：

a） 数学和自然科学类课程对微积分、几何与代数、概率与数理统计、大学物理等相关知识和运用能力有较好支撑；

b） 工程基础类课程具有较好的工程力学、工程图学、运筹学工程基础，并对土木工程基础、机械工程基础、电工电子基础、计算机技术基础、信息控制技术基础等部分相关领域的工程能力有较好支撑；

c） 设置符合专业核心教育定位的专业课程和实践环节，实践环节应包括实验、课程设计、实习及工程训练等，毕业设计（论文）以工程设计为主。

5.9.3 师资队伍

该项应包括：

a） 从事专业基础类、专业类课程教学的主讲教师，原则上具有硕士或博士学位；

b） 讲授专业课程的教师，每3年应有3个月以上的工程实践经历；

c） 专业教师中高级职称教师占专任教师的比例不低于45％。

5.10 矿业类专业

5.10.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的采矿工程、矿物加工工程、矿物资源工程等矿业类专业。

5.10.2 课程体系

课程设置应满足：

a) 学生在毕业时学习足够的专业课程、接受足够的专业教学环节的训练，满足煤和非煤固体矿产资源（不包括石油和天然气田等液态资源）的开采与矿物加工的需要；

b) 专业课有与课程目标要求相匹配的课堂教学、课后自主学习以及与培养学生解决复杂工程问题能力相适应的课程作业及要求，并在课程教学大纲的成绩评定方法和评分标准中有明确要求且有效实施；

c) 课程教学内容与时俱进且不断完善，以适应社会对现代化矿业类人才的需求；

d) 专业实践教学环节包含：

- 至少3次体现不同教学目的的校外实习（总学时不少于8周）；
- 毕业设计（论文）时间不少于12周，其中工程设计占与专业定位相适应的比例，并且来源于矿业类工程实践的选题比例不低于80％。

5.10.3 师资队伍

专任教师在其学习经历中至少有一个阶段是矿业类专业学历，从事专业教学工作的教师应具有6个月以上的矿业相关工程实践经历。

5.11 食品科学与工程类专业

5.11.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的食品科学与工程类专业。

5.11.2 课程体系

课程设置应满足：

a） 学生在毕业时具备工程制图、信息、机械工程、单元操作等方面的工程基础；

b） 实践教学体系能结合食品行业或产业的工程实际问题，开展工程实践训练，强化工程意识和提供工程实践经历。

5.11.3 师资队伍

从事专业课程授课的教师，在其学习经历中至少有一个阶段是食品科学与工程类或相关专业学位，且有 6 个月以上的相关工程实践经历。

5.12 材料类专业

5.12.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的材料类专业。

5.12.2 课程体系

课程设置应确保学生在毕业时：

a） 具备应用自然科学（含高等物理和高等化学等）、计算机技术和工程原理等知识的能力；

b） 能系统理解并能够综合应用有关材料（含冶金）领域中组成与结构、性质、合成与制备（含工艺流程等）、应用（含使用性能）等方面的科学与工程原理；

c） 能通过理论分析、实践和实训、逻辑计算、统计以及建立数学模型等方法，解决合成与制备等工艺过程的材料选择、设计、工艺（含新工艺新流程等）及参数确定等材料（含冶金）领域复杂工程问题。

5.12.3 师资队伍

从事专业课程教学的教师，专业知识应覆盖专业领域中有关组成与结构、性质、合成与制备（含工艺流程等）、应用（含使用性能）等方面

的内容。

5.13 仪器类专业

5.13.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的仪器类专业。

5.13.2 课程体系

课程设置应满足：

a) 支持学生掌握信息获取、信息处理和信息利用的基本知识，包括传感器理论与应用、测量理论与测试技术、测控系统与仪器产品智能化及其制造等领域的核心概念、基本原理、基本技术和基本方法；

b) 能围绕准确获取信息，运用基本知识分析、设计、开发、应用仪器部件（元件）、整机或测控系统，培养学生系统思维和仪器与测控系统性能评价的能力；

c) 专业实践环节保证学生熟悉仪器设计、制造过程，了解仪器生产组织方式和管理流程。

5.13.3 师资队伍

80％以上的专任教师具有在企业连续工作半年以上的经历，或取得相关专业工程技术系列职业资格，或通过相关专业技术人员水平评价。

5.14 测绘地理信息类专业

5.14.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的测绘地理信息类专业。

5.14.2 课程体系

课程设置应满足：

a) 支持学生掌握地球空间信息科学与技术的基本知识，包括地理时空基准、大地测量与导航定位、工程与工业测量、摄影测量与遥感、地图制图与地理空间信息工程以及测绘地理信息技术在相关应用领域的核心概念、基本原理、技术、方法和测绘与地理信息服务相关政策、法规等；

b) 培养学生测绘地理信息的数据采集、处理、分析、服务能力；

c) 使学生受到足够的专业工程训练，包括专业实践环节；专业课程有培养学生解决复杂工程问题能力的作业或设计；

d) 专业实践教学环节至少包含：

- 核心专业课程有工程案例分析和适当规模的程序设计作业；
- 有校企联合且运行良好的实训基地，有不少于2周的实训经历；
- 毕业设计（论文）完成时间不少于12周，选题有明确的应用背景。

5.14.3 师资队伍

该项应包括：

a) 专业课授课教师在其学习经历中至少有一个阶段是测绘地理信息类专业学历；

b) 从事核心专业课程授课的教师，应具有主持完成测绘地理信息工程项目的能力与相应经历。

5.15 地质类专业

5.15.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的地质类专业。

5.15.2 课程体系

课程设置应满足：

a) 野外地质工作和工程技术基本技能训练，包括地质及工程基础教学实习和专业实践环节，且地质及工程基础教学实习野外教学时间不少于5周；

b) 培养学生运用地质学和工程学的基本概念、原理和分析方法，观察、分析和描述野外地质现象的能力，掌握解决现场工程问题的方法与技术；

c) 专业实践环节时间安排不少于5周，有野外、场地和室内工作量，并形成报告（设计/论文），培养学生解决地质类工程问题的能力。

5.15.3 师资队伍

该项应包括：

a) 从事专业课程教学的教师在其学习经历中，至少有一个阶段是地质类专业学历；

b) 从事专业教学工作的80％以上教师，至少有累计1年以上地质类企业或工程实践（包括企业工作或完成工程类项目、应用型研究项目）经历。

5.16 纺织类专业

5.16.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的纺织工程、服装设计与工程和非织造材料与工程等纺织类专业。

5.16.2 课程体系

课程设置应确保学生在毕业时：

a) 掌握揭示纤维及其集合体的组成结构、形态特征、性能演变及

其规律的纺织材料学知识集；

b） 掌握涵盖整个纺织生产链和全生命周期调控的纺织工程学知识集；

c） 掌握兼顾科技和人文属性、艺术和功能统一的纺织类产品设计学知识集，以及掌握从设计、制造到销售并集成信息、经济、社会等要素的纺织管理学知识；

d） 能综合运用上述知识和原理，解决纤维与纤维集合体由原材料状态向制品状态转换过程中的复杂工程问题，并注重制造过程的高效化、精细化及人体和环境友好。

5.16.3 师资队伍

该项应包括：

a） 从事专业教学工作的70％以上的教师在其学习经历中，至少有一个阶段是纺织类专业学历；

b） 80％以上的教师至少有6个月以上纺织类或相关企业工程实践经历。

5.17 核工程类专业

5.17.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的核工程类专业。

5.17.2 课程体系

课程设置应满足：

a） 至少包含如下知识领域之一：理论力学、量子力学、电动力学、统计力学、流体力学、热力学、放射化学、化工原理；

b） 使学生掌握核物理、辐射探测、辐射防护的基础知识，具备相适应的实验、信息技术、电工电子技术和工程制图能力；

c） 专业课程体现核安全文化；

d） 毕业设计（论文）应一人一题。

5.17.3 师资队伍

该项应包括：

a) 从事专业课程教学的教师，具有核工程类或核物理专业的学历或进修经历，或者有在核工程类相关企业/研究院所的工作经历；

b) 从事专业教学（含专业实验教学）的教师，80％以上具有累计不少于半年相关企业或研究机构的工程实践经历；

c) 认证专业的专任教师中再列入其他认证专业的不得超过50％。

5.17.4 支持条件

专业所在学校应具有从事放射性工作的资质和许可证。

5.18 兵器类专业

5.18.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的兵器类专业。

5.18.2 师资队伍

从事专业教学工作的教师在其学习经历中至少有一个阶段是兵器类专业学历，或具有兵器行业科研经历，或具有兵器行业工程实践经验。

5.19 土木类专业

5.19.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的土木类专业。

5.19.2 课程体系

课程设置应满足：

a） 学生在毕业时能够应用工程力学、结构力学、流体力学、工程材料、工程测量、工程制图、工程经济等工程基本原理与方法；
b） 使学生掌握土木类工程设施或系统的设计、建造、运维、管理的核心概念与专业技术；
c） 使学生具有综合运用宽口径专业知识和技能识别、表达、分析和解决土木类复杂工程问题的能力。

5.19.3 师资队伍

该项应包括：
a） 从事专业课程教学（含实践教学）的教师，在其学习经历中至少有一个阶段是土木类相关专业学历；
b） 从事专业主干/核心课程（含实践环节）教学工作的教师具有相应的工程实践经历；
c） 承担专业课程教学的骨干教师有明确稳定的研究方向；
d） 专任教师每年实际指导毕业设计的学生不超过8人。

5.19.4 支持条件

有满足教学需要的现行工程建设法规文件、国家标准、行业标准和工程图集，有课程教学和毕业设计所必需的正版专业软件，有相对稳定的校外专业实习基地。

5.20 能源动力类专业

5.20.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的能源与动力工程、能源与环境系统工程、新能源科学与工程、储能科学与工程、能源服务工程、氢能科学与工程、可持续能源等能源动力类专业。

5.20.2 课程体系

课程设置应满足：

a） 自然科学类课程包含物理、化学（也可包含生命科学）等知识领域；

b） 工程基础类课程包含机械设计基础、工程力学基础、电工电子技术基础、计算机基础、控制基础和环境工程基础等知识领域；

c） 专业基础类和专业类课程可依据各校专业优势和专业方向特点设置，包含工程热力学、流体力学、传热学（也可包含燃烧学）、热能与动力测试技术等知识领域以及与所设专业密切相关的重要知识领域；

d） 实践环节包括专业教学实验、创新创业训练、课程设计、企业实习或生产实习等，毕业设计（论文）以工程设计为主，包含有一定综合性和复杂性的研究和设计环节。

5.20.3 师资队伍

从事专业课程教学的教师，应具有本专业及相关工科专业的学历，或者具有两年以上在能源动力类相关企业、研究机构从事设计、研发、工程或管理实践的经历，了解本专业领域科技的最新发展。

5.21 轻工类专业

5.21.1 适用专业领域

按照教育部规定设立的，授予工学学士学位的轻化工程、包装工程、印刷工程、香料香精技术与工程、化妆品技术与工程和生物质能源与材料等轻工类专业。

5.21.2 课程体系

课程设置应满足：

a） 确保本专业学生在毕业时具备数学、自然科学、工程科学原理和实验方法、专业知识等方面的工程基础；

b） 确保实践教学体系能结合轻工行业的工程实际问题和需要，

开展工程实践训练，强化工程意识和提供工程实践经历；

c） 课程教学内容要与时俱进地不断完善，以适应社会进步和科技发展对轻工类人才的需要。

5.21.3 师资队伍

该项应包括：

a） 从事专业主干课程教学的教师，具有企业工作经验或从事过相关工程实践和研究的经历，了解本专业领域科学和技术的最新发展；

b） 制定了青年教师工程能力、教学能力的培养计划。

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T/CEEAA 001—2022

Engineering education accreditation criteria

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Contents

Foreword

This document is in accordance with the provisions of GB/T 1.1—2020 *Directives for standardization—Part* 1：*Rules for the structure and drafting of standardizing documents*.

Please note that some of the contents of this document may involve patents. The issuing agency of this document is not responsible for identifying patents.

This document was proposed by the China Engineering Education Accreditation Association（CEEAA）and the Education Quality Evaluation Agency of the Ministry of Education，and is managed by CEEAA.

Drafting organizations of this document：China Engineering Education Accreditation Association，Education Quality Evaluation Agency of the Ministry of Education，China Association for Standardization，Geological Society of China，China Society for Geodesy Photogrammetry and Cartography，China Electrotechnical Society，Chinese Society for Electrical Engineering，China Ordnance Society，China Electricity Council，Chinese Institute of Electronics，China National Textile and Apparel Council，Chinese Society for Composite Materials，China Iron and Steel Association，China Association of Higher Education，China Optics and Optoelectronics Manufacturers Association，Chinese Aerospace Society，China Nuclear Energy Association，China Nuclear Energy Society，China Environmental Protection Industry Association，China Environmental Science Society，China Mechanical Engineering Society，China Machinery Industry Association，China Architecture Society，China Construction Materials

Council，China Communications Education Institute，China Communications and Transportation Association，China Metals Society，China Construction Education Association，China Mining Association，China National Coal Association，China Agricultural Engineering Society，Chinese Society of Automotive Engineering，Chinese Council of Light Industry，Chinese Association of Software Industry，Chinese Association of Petroleum and Chemical Industry，Chinese Institute of Food Science and Technology，Chinese Society of Hydraulic Engineering，Chinese Society of Railway Engineering，Chinese Institute of Communications，Chinese Society of Civil Engineering，Chinese Society of Measurement and Control Engineering，Chinese Association of Nonferrous Metal Industry，Chinese Society of Naval Architects and Marine Engineers，Chinese Association of Occupational Safety and Health，Chinese Association for Automation，CAST Center for Professional Training and Services，China Highway and Transportation Society，International Centre for Higher Education Innovation under the auspices of UNESCO（Shenzhen，China），China Textile Engineering Society，Education Evaluation Center of Henan，Guangdong Institute of Engineers，Shanghai Institute of Engineers，Jiangsu Institution of Engineers，Jiangsu Agency for Educational Evaluation，Heilongjiang Institute of Teacher Development（Heilongjiang Agency for Educational Evaluation），Beijing Institute of Engineers，Chongqing Engineers Association，Shandong Engineers Association.

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Introduction

Engineering education accreditation is an internationally recognized quality assurance system for engineering education and an essential basis for international mutual recognition of engineering education and engineer qualifications. Engineering education accreditation in China began in 2006 and is the foundation and an essential part of the reform of the engineering system. In 2016, China joined the Washington Accord as a full signatory.

The goals of engineering education accreditation are: To promote the construction of an engineering education quality assurance system in China, to promote the reform of engineering education in China, and to further improve the quality of engineering education; To establish an engineering education accreditation system in conjunction with the engineer ing circles, to promote the link between education and industry, and to improve the adaptability of engineering talent training to industrial development; To promote international mutual recognition of Chinese engineering education in the world.

China Engineering Education Accreditation Association (CEEAA) is a voluntarily established, non-profit, national, membership-based social organization by associated groups and individuals committed to China's engineering education.

Since the naissance of engineering education accreditation in China, CEEAA and associated agencies released the "*Criteria for engineering education accreditation*" in accordance with the education practices in China, based on the prevailing practices of the international engineering education community and the principle of substantial equivalence. According to the Council meeting decision of CEEAA, the "*Criteria for engineering education accreditation*" was revised and redesigned to form this document, which meets the relevant requirements of education evaluation in the new engineering era.

CEEAA will constantly revise this document.

The principles of this document have been implemented for many years and have undergone many revisions and iterations by many leaders, experts, and staff involved in this work. Due to the limited space, we are not able to list all the contributors. We would like to take this opportunity to express our gratitude to them.

Feedback, comments and suggestions on the document are welcome by CEEAA at the postal address of No.30, Xueyuan Road, Haidian District, Beijing, zip code: 100083, and e-mail of ceeaa@cast.org.cn.

Engineering education accreditation criteria

1 Scope

This document specifies the general criteria of the engineering education accreditation and the complementary program criteria.

This document applies to engineering education accreditation of engineering programs awarding bachelor's degree with four-year full-time study at higher education institutions.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

The following terms and definitions apply to this document.

3.1
educational objectives

Broad statements that describe what students are expected to attain within five years after graduation.

3.2
graduate outcomes

Statements that describe what students are expected to know and be able to do by graduation.

NOTE Statements relate to skills, knowledge and behaviors that students acquire as they progress through the program.

3.3
assessment

One or more processes that identify, collect and prepare data to evaluate the attainment of program course teaching, student training, graduate outcomes, educational objectives, etc..

NOTE Effective assessment uses relevant direct, indirect, quantitative and qualitative measures appropriate to the assessable outcome. Appropriate sampling methods may be used as part of an assessment process.

3.4
evaluation

One or more processes for interpreting the data and evidence accumulated through assessment processes.

NOTE Evaluation results in decisions and actions regarding program improvement.

3.5
mechanism

A set of standardized processing procedures for specific purposes.

NOTE Including purposes，relevant regulations，responsible personnel，methods and procedures，clearly defines the roles and responsibilities of personnel involved in the process.

3.6
complex engineering problem

The problem that cannot be solved without in-depth engineering knowledge and analysis.

NOTE With some or all of the following features：

a） It involves various technical，non-technical，and other factors，which have certain conflicts with each other；

b） It can only be solved by establishing an appropriate abstract model，and creativity needs to be reflected in the modeling process；

c） It cannot be solved entirely by standard methods；

d） The factors involved in the problem may not be fully included in the standards and specifications of professional engineering practice；

e） The stakeholders involved in the problem are not consistent；

f） It is highly comprehensive and contains many interrelated sub-problems.

4 General criteria

4.1 Students

This item includes the following factors：

a） The program must have policies and procedures to attract outstanding students；

b） The program must have enforced policies and procedures on learning advising，career planning，employment guidance and psychology counseling for students；

c） The program must track and evaluate student's outcomes throughout the learning process，and to ensure and document that students achieve the graduate outcomes through formative evaluation；

d） The program must have specific requirements and processes for awarding appropriate academic credits of transfer students.

4.2 Educational objectives

This item includes the following factors：

a） The program must have published educational objectives consistent with the mission of the institution and the needs of social and economic development；

b） The program must periodically review the educational objectives to ensure they remain consistent with the institutional mission and social & economic development. The review process must involve experts from industry or enterprises.

4.3 Graduate outcomes

The program must have clearly documented, published and assessable graduate outcomes. The documented graduate outcomes prepare graduates to attain the program educational objectives. The documented graduate outcomes must include:

a) Engineering knowledge: Apply knowledge of mathematics, natural science, engineering fundamentals and engineering specialization to solve complex engineering problems;

b) Problem analysis: Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences;

c) Design/development of solutions: Design solutions for complex engineering problems and design systems, components, or processes that meet specified needs with appropriate societal, public health and safety, legal, cultural and environmental considerations;

d) Investigation: Conduct investigations of complex problems using research-based knowledge and research methods, including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions;

e） Modern tool usage：Create，select and apply appropriate techniques，resources，and modern engineering and IT tools，including prediction and modeling，to complex engineering problems，with an understanding of the limitations；

f） Engineer and society：Apply reasoning informed by the contextual knowledge to assess societal，health，safety，legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems；

g） Environment and sustainability：Understand and evaluate the sustainability and impact of professional engineering work in solving complex engineering problems in societal and environmental contexts；

h） Professional ethics：Have humanities and social science qualities，social responsibility，apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice；

i） Individual and team work：Function effectively as an individual，team member and principal in a multi-disciplinary team；

j） Communication：Communicate effectively on complex engineering activities with the engineering community and with society at large，such as being able to comprehend and write effective reports and design documentation，make effective presentations，and give and receive clear instructions. Have a particular international perspective，communicate and exchange in the cross-cultural context；

k） Project management：Understand and master engineering management principles and economic decision-making methods，and apply them in a multi-disciplinary environment；

l） Lifelong learning：Recognize the need for，have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

4.4 Continuous improvement

This item includes the following factors：

a） The program must establish regulations and mechanism to monitor teaching quality. There must be clear quality standards of main teaching process. The program must periodically evaluate curriculum and its quality. The program must establish regular，appropriate，documented process and mechanism to assess and evaluate the extent to which the graduate outcomes are being attained；

b） The program must have the feedback mechanism from industry and society，including graduates and employers，to evaluate the extent to which the educational objectives are being attained；

c） The results of periodical evaluation must be systematically utilized as input for program's continuous improvement actions.

4.5 Curriculum

The curriculum must be designed to help the attainment of graduate outcomes. The design of the curriculum must involve experts from the enterprises or industry. The curriculum must include:

a) Courses on mathematics and nature sciences consistent with the graduate outcomes (accounting for at least 15% of the total credits);

b) Courses on engineering foundation requisite, courses on subject foundation requisite and subject elective courses (accounting for 30% of the total credits). Courses on engineering foundation requisite and courses on subject foundation requisite may provide training in the ability to apply mathematics and natural science in solving complex problems related to the professional discipline. Subject elective courses can fully assume the role of training abilities in system design and implementation;

c) Engineering practice and graduate design (thesis) (accounting for 20% of the total credits). The program has a well-established practice education system and cooperate with enterprises to educate students on practical and innovative abilities. The topics of graduate design (thesis) are oriented from the practical engineering problem to educate students engineering awareness, cooperation and abilities to systematically utilize what they have learned to solve complex engineering problems. The guidance and evaluation of graduation design (thesis) involve experts from industry or enterprises;

d) Courses on humanities, social sciences and general education (accounting for at least 15% of the total credits) to enable students to consider the economic, environmental, legal, safety, health and ethical constraints in engineering practice.

4.6 Faculty

This item includes the following factors：

a） The faculty is sufficient and has a reasonable structure to meet the program’s teaching requirements. The program must have part-time faculty members from industry or enterprises；

b） Each faculty member must have proper teaching，professional practice，communication，career development and engineering research abilities. The professional background of each faculty member must meet the program’s teaching needs；

c） The faculty members must have sufficient time and effort devoted to undergraduate teaching and student advising and actively participate in research and reform on teaching；

d） The faculty members must provide student advising，counseling and service activities and accommodate adequate levels of career planning and professional education to the students；

e） The faculty members must understand their responsibilities in the program’s quality improvement and continuously improve their work.

4.7 Supporting resources

This item includes the following factors：

a） Classrooms，laboratories，practice and exercise workshops，associated equipment are adequate to satisfy teaching needs. The program must have well-established management, maintenance and update mechanism of the facilities enabling students to access. The program cooperates with enterprises to establish practice and exercise bases and provide the engineering practice platform for the student during the teaching process;

b) Computer facilities, network conditions, books and documents sufficient to satisfy the needs of teaching and scientific research of the students and faculty. These resources are systematically maintained and accessible, and have a high degree of sharing;

c) Financial resources must be sufficient to meet the needs of teaching;

d) The institution must attract and retain qualified faculty and effectively support faculty development, especially the guidance and training of young faculty;

e) The institution must have sufficient infrastructure to meet the needs of graduate outcomes and support students' practice and innovation activities;

f) The institution must have well-established teaching management and service to support the attainment of graduate outcomes.

5 Complementary program criteria

5.1 Precautions

The program must meet its corresponding complementary program criteria. Complementary program criteria stipulate special requirements on curriculum，faculty and supporting resources.

5.2 Complementary criteria for Mechanical and Similarly Named Engineering Programs

5.2.1 Applicable programs

These complementary program criteria apply to those programs established in accordance with the relevant regulations of the Ministry of Education，conferring a bachelor’s degree in engineering. The program’s name includes “mechanical” or similar modifiers such as machinery，material forming，process equipment，and vehicles.

5.2.2 Curriculum

The curriculum should include natural science courses，basic engineering courses，practical links，and meets the following requirements：

a） Natural science courses cover areas of knowledge such as physics，chemistry（or life sciences）；

b） Engineering introductory courses cover knowledge fields such as engineering graphics，theoretical mechanics，mechanics of materials，thermofluids，electrical and electronics，engineering materials；

c） The practical activities include engineering training，course laboratory，course design，enterprise internship，innovations in science and technology，etc.. The graduation project（thesis）is mainly based on engineering design.

5.2.3 Faculty

The faculty members of the major courses have professional experience in enterprises or engineering fields of technical design and research, and be aware of the latest developments in science and technology in the related field of the program.

5.3 Complementary criteria for Computer and Similarly Named Engineering Programs

5.3.1 Applicable programs

These complementary program criteria apply to the programs of computer science and technology, software engineering, and other computer-engineering-related ones authorized by the Ministry of Education, which award bachelor's degrees to students who meet the corresponding standards.

5.3.2 Curriculum

The curriculum must meet the following requirements:

a) To assist students in mastering fundamental knowledge of the characteristics of computer systems abstraction and automation, including core concepts, fundamental principles, appropriate methods, and technologies for the following disciplines: discrete structures, programming, data structures, computer algorithms, computer architecture, operating systems, computer networks, software development procedures，data management，and applications；

b） To assist students in developing computational thinking，understanding fundamental algorithms，programming and systematic skills. Students can apply the appropriate knowledge to design，implement and/or use complex computer systems；

c） To ensure that students receive sufficient training，including course projects and professional practice；

d） Courses in the program，especially foundation courses，require students to complete specific homework assignments of an appropriate difficulty level to demonstrate their competency in solving complex engineering problems；

e） Professional practice includes，at a minimum：

- Two systems design and development projects with an appropriate amount of work requiring integrated knowledge from multiple courses；

- The project design/thesis（at least 8% of the total credits or more than 14 weeks）demonstrate a clearly defined application background and reflect the students’ comprehensive system development skills training.

5.3.3 Faculty

Most faculty members have at least one stage of their learning experience as a computer science major.

5.4 Complementary criteria for Chemical, Biochemical and Similarly Named Engineering Programs

5.4.1 Applicable programs

These complementary program criteria apply to the programs that include Chemical Engineering, Pharmaceutical Engineering, Biochemical Engineering, Applied Chemistry, Biotechnology, Bioinformatics, Petroleum Engineering, Oil and Gas Storage and Transportation Engineering, Marine Oil and Gas Engineering, or similar modifiers in their titles, as determined in accordance with relevant regulations of Ministry of Education, and that graduate with a Bachelor of Engineering degree.

5.4.2 Curriculum

The curriculum must meet the following requirements:

a) Ensure graduates can apply knowledge of mathematics (including advanced mathematics and linear algebra), natural science (including chemistry, physics, and biology), principles of engineering (including information, machinery, and control), and experimental methods to express and analyze complex engineering problems in chemical, physical and biological processes;

b) Students are able to investigate, simulate and design chemical, physical and biological processes with the knowledge and capacity of system optimization;

c) Students are able to understand and analyze HSE risks and hazards in chemical, physical and biological processes, with knowledge of HSE management system of modern enterprises.

5.4.3 Faculty

The faculty must meet the following requirements:

a) More than 80% of teaching faculty members have engineering experience in enterprise for at least 6 months;

b) The faculty members of safety, environmental protection and engineering design courses have engineering experience in relevant areas.

5.5 Complementary criteria for Water Conservancy and Similarly Named Engineering Programs

5.5.1 Applicable programs

These complementary program criteria apply to the programs that include water conservancy and agricultural water conservancy engineering in agricultural engineering, which are established in accordance with the regulations of the Ministry of Education to award the bachelor's degree in engineering.

5.5.2 Curriculum

The curriculum must meet the following requirements：

a) Conforming to engineering logic and covering the training of knowledge，ability，and quality to solve complex engineering problems in the whole cycle and whole process，including water conservancy survey，planning，design，implementation，management and maintenance，and enabling students to solve engineering problems considering various constraints；

b) Basic knowledge of ecology and environment and expertise in ecology and environment of water conservancy. Be able to analyze and evaluate the impact of solutions to solve complex engineering problems of water conservancy on ecology and environment，and consider the constraints of ecology and environment；

c) Each link of engineering practice pays attention to the cultivation of engineering ability：

- The course experiments have comprehensive experiment items；
- The practices include understanding the complexity of hydraulic engineering problems；
- There are no less than 4 course designs，including no less than 2 subject elective course designs；
- The student doing a graduation thesis have at least one subject elective course design that allows him to be trained

in solving complex engineering problems；

- The time of graduation design（thesis）is no less than 12 weeks，including the understanding and evaluating economic decision-making and ecological environment impact.

5.5.3 Faculty

The faculty must meet the following requirements：

a） More than 40% of the faculty members of courses on subject foundation requisite and subject elective courses have senior titles. Hiring enterprise or industry experts as part-time teachers undertake certain teaching tasks in the training program；

b） The faculty members of subject elective courses have at least one professional education background same as the relative major in different educational levels such as bachelor，master，PhD，and the teacher has the research orientation and professional experience the same as or similar to relative major；

c） More than 85% of the faculty members of subject elective courses have experience in engineering practice in their field，and more than 15% faculty members have accumulated more than half a year of engineering practice experience in water conservancy enterprises and institutions or similar units；

d） The program has a training plan to develop young teachers’ engineering ability，knowledge integration ability，and teaching skills.

5.6 Complementary criteria for Environmental and Similarly Named Engineering Programs

5.6.1 Applicable programs

These complementary program criteria apply to programs that include environmental-related engineering programs leading to engineering education bachelor degree, as established consistent with the regulations of the Ministry of Education.

5.6.2 Curriculum

The curriculum must meet the following requirements:

a) Students, upon graduation, are capable of applying knowledge of mathematics (including advanced mathematics, linear algebra, probability theory, mathematical statistics, etc.), natural sciences (including chemistry, physics, biology, etc.), engineering science principles, and experimental methods, professional knowledge (including prevention and control of wastewater, waste gas and solid waste and their resources conservation-oriented utilization, ecological restoration, etc.), economic decision making, engineering management as well as modern tools;

b) Students have a good command of knowledge in project-related safety, health and sustainable development of the environment. They can identify, express, plan, manage, simulate, analyze, assess, research, develop, design and optimize ecological and environmental protection, and pollution prevention and control. They can analyze, assess and control the impacts of projects on society, health, safety and environment, and understand the social responsibilities attributable to them;

c) Students have received sufficient specialty practice training in practice teaching.

5.6.3 Faculty

The faculty must meet the following requirements:

a) The faculty members of professional courses have the learning experience identical to the specialty;

b) The faculty members engaging in specialty teaching have undergone related engineering practice experience of more than 6 months.

5.7 Complementary criteria for Safety Science and Engineering and Similarly Named Engineering Programs

5.7.1 Applicable programs

These complementary program criteria apply to programs of safety science and engineering that are established in accordance with the regulations of the Ministry of Education to award a bachelor of engineering degree.

5.7.2 Curriculum

The curriculum must meet the following requirements：

a） Be able to identify hazards based on the academic knowledge of mathematics，natural science，engineering science，management science and experimental means；

b） Be able to analyze，design，study，express and optimize solutions for risk mitigations；

c） Be able to carry out the design schemes and evaluate implementation performance.

5.7.3 Faculty

The faculty members engaged in professional teaching work have at least one degree in safety science and engineering，or have more than two years of working experience in safety-related education and training，scientific research，engineering，or management practice.

5.8 Complementary criteria for Information，Electronic，Electrical and Similarly Named Engineering Programs

5.8.1 Applicable programs

These complementary program criteria apply to programs are established in accordance with the regulations of the Ministry of Education to award a bachelor degree of Engineering in information，electrical， electronic and automation programs.

5.8.2 Curriculum

The curriculum must meet the following requirements：

a） Provide modern engineering education content with the required breadth and depth consistent with the program title；

b） Cover the knowledge fields and applications of mathematics and natural sciences（including physics，can also including chemistry，life science，earth science，space science，etc.），as well as the modern engineering content necessary for analyzing and designing complex systems and situations（including hardware，software，and systems composed of hardware and software） that are consistent with the program title；

c） Cover the following areas of knowledge：

- Electrical Engineering Programs include knowledge/courses such as electromagnetic theory and energy conversion principle，which support the cultivation of cognitive recognition，planning and design，operation control，analysis and calculation，experimental testing，simulation，and other abilities in Electrical Engineering（including electric energy production，transmission，application，etc.）；

- Information，Electronics and Communication Engineering Programs include knowledge/courses such as physical mechanisms， electronic circuits, signal/information acquisition and processing, information computing and storage, communication transmission, network interconnection, mobile applications, and other core knowledge fields, which support the cultivation of related materials, components, circuits, signals, information, networks, and applications in Electronics, Information and Communication Engineering (including electronics, photonics, information, etc.);

- Automation Engineering Programs include core knowledge fields/courses such as modeling, detection, control, system integration and application technology, which support the cultivation of system modeling, detection and identification, information processing and analysis, automatic control, optimization decision-making, system integration and artificial intelligence applications in modern Automation Engineering;

- Courses of other programs can choose the core knowledge fields of similar programs or be set according to the professional characteristics.

5.8.3 Faculty

The faculty must meet the following requirements:

a) The faculty members of subject courses understand the latest progress in related engineering fields and practice;

b) The faculty members of core design courses possess sufficient educational background and design experience. Education progress cannot rely on one faculty.

5.9 Complementary criteria for Traffic and Transportation and Similarly Named Engineering Programs

5.9.1 Applicable programs

These complementary program criteria apply to programs that include traffic and transportation and similarly named engineering established in accordance with the regulations of the Ministry of Education to award a bachelor’s degree in engineering.

5.9.2 Curriculum

The curriculum must meet the following requirements：

a） Mathematics and natural science courses have good support for knowledge and application ability in calculus，geometry and algebra，probability and mathematical statistics，college physics，etc.；

b） Engineering introductory courses have a good engineering foundation of engineering mechanics，engineering graphics，and operations research，and have good support for engineering ability in some related fields such as civil engineering foundation，mechanical engineering foundation，electrical and electronic foundation，computer technology foundation，information control technology foundation，etc.；

c） Set up professional courses and practical programs in line with the orientation of professional core education. The practical programs include experiments，course design，practice and engineering training，etc.，and the graduation project（thesis）mainly base on engineering design.

5.9.3 Faculty

The faculty must meet the following requirements：

a） The main faculty members of courses on subject foundation requisite and subject elective courses，in principle，have a master's degree or doctoral degree；

b） The faculty members of professional courses have more than 3 months of engineering practice experience every 3 years；

c） The proportion of full-time faculty with intermediate and senior professional titles is no less than 45%.

5.10 Complementary criteria for Mining and Similarly Named Engineering Programs

5.10.1 Applicable programs

These complementary program criteria apply to programs that include mining majors established in accordance with the regulations of the Ministry of Education，including Mining Engineering，Mineral Processing Engineering，Mineral Resources Engineering，etc.，to award a bachelor's degree in engineering.

5.10.2 Curriculum

The curriculum must meet the following requirements：

a） The students take enough professional courses and receive enough training to meet the requirements of the exploration and processing of coal and other solid mineral resources（excluding liquid resources such as oil and gas fields）before graduation；

b） The professional courses are equipped with classroom teaching，independent learning，and homework that develops the ability to solve complicated engineering problems. The grading standard and evaluation method are clearly specified in the syllabus and be strictly implemented；

c） Keep the course up-to-date to meet the demands for talents in modern mining；

d） The following aspects are included in practice teaching：

- Social practice with different teaching aims for 3 times at least（no less than 8 weeks in total）；
- No less than 12 weeks for graduation project/thesis，among which the proportion of engineering design match the professional orientation；the proportion of selected topics in mining engineering practice should not be less than 80%.

5.10.3 Faculty

At least one stage of mining-learning experience with a professional degree is required for each full-time faculty member. At least 6 months of practical experience in mining engineering is required for faculty members who are engaged in professional teaching.

5.11 Complementary criteria for Food and Similarly Named Engineering Programs

5.11.1 Applicable programs

These complementary program criteria apply to food and similarly named engineering programs established in accordance with the regulations of the Ministry of Education to award a bachelor's degree in engineering.

5.11.2 Curriculum

The curriculum must meet the following requirements:

a) Upon graduation, students have the engineering fundamentals of engineering drawing, information, mechanical engineering, unit operation, etc.;

b) The practical teaching can combine the actual engineering problems in the food industry or industry, carry out engineering practice training, strengthen engineering awareness, and provide engineering practice experience.

5.11.3 Faculty

Faculty members of professional courses have at least one stage of their learning experience in food science and engineering or related professional degrees and have more than 6 months of relevant engineering practice experience.

5.12 Complementary criteria for Material and Similarly Named Engineering Programs

5.12.1 Applicable programs

These complementary program criteria apply to all of the material programs which are established in accordance with the regulations of the Ministry of Education and awarded the bachelor's degree in engineering.

5.12.2 Curriculum

The curriculum must meet the following requirements:

a) To apply advanced science (such as physics and chemistry), computational techniques and engineering principles to materials systems;

b) To systematically understand and comprehensively apply the scientific and engineering principles underlying the four major elements of the field: structure, properties, synthesis and preparation (including technological processes), and applications (including performance) to the field of materials (including metallurgy);

c） To apply and integrate knowledge from the above four elements of the field using theoretical，experimental，computational，statistical and modeling methods to solve complex engineering problems，including selection，design，process，and parameter determination.

5.12.3 Faculty

The faculty members of the professional courses must encompass the four major elements of the field.

5.13 Complementary criteria for Instrument and Similarly Named Engineering Programs

5.13.1 Applicable programs

These complementary program criteria apply to instrument-related engineering programs established in accordance with the regulations of the Ministry of Education to award a bachelor's degree in engineering.

5.13.2 Curriculum

The curriculum must meet the following requirements：

a） Support students to grasp the basic knowledge of information acquisition，information processing and information utilization，including the core concepts，basic principles，fundamental technologies and primary methods in the fields of sensor theory and application，measurement theory and testing technology，measurement and control system and instrument product intelligence and its manufacturing;

b) Be able to analyze, design, develop and apply instrument components (elements), complete machine or measurement and control systems by applying basic knowledge around accurately obtaining information, and cultivate students' system thinking ability and performance evaluation of instruments and measurement and control system;

c) Professional practice ensure that students are familiar with the instrument design and manufacturing processes, and understand the instrument production organization and management process.

5.13.3 Faculty

More than 80% of full-time faculty members must have more than half a year of continuous work experience in the enterprise, or have obtained the professional qualification of Engineering Technology in a relevant program, or have passed the level evaluation of relevant professional technicians.

5.14 Complementary criteria for Surveying, Mapping and Geoinformation and Similarly Named Engineering Programs

5.14.1 Applicable programs

These complementary program criteria apply to programs that include surveying, mapping and geoinformation engineering programs established in accordance with the regulations of the Ministry of Education to award a bachelor’s degree in engineering.

5.14.2 Curriculum

The curriculum must meet the following requirements：

a) Students are expected to know the basic knowledge of geoinformatics，including space-time datum，geodesy and navigation，engineering survey，photogrammetry and remote sensing，cartography and geoinformation systems，and surveying and mapping geographic information technology-related policies and regulations；

b) Students are able to collect，process，and analyze geoinformation and to serve geoinformation services；

c) Students are well trained for professional engineering training，including professional practices. These training and courses include tasks and designs to solve complex engineering problems；

d) Sessions for practical training include the following：

- Core professional courses include case analysis for technical projects and programming assignments；
- Courses have a well-established practice base in collaboration with companies，where students have at least two weeks of practice；
- The duration of the thesis is at least 12 weeks，and the

thesis topics are related to technical practice.

5.14.3 Faculty

The faculty must meet the following requirements：

a） The faculty members of professional courses have at least one degree in surveying，mapping and geospatial information；

b） The faculty members of core professional courses have the ability and appropriate experience to lead the implementation of surveying and mapping projects in geospatial information technology.

5.15 Complementary criteria for Geology and Similarly Named Engineering Programs

5.15.1 Applicable programs

These complementary program criteria apply to geology engineering programs established in accordance with the regulations of the Ministry of Education to award a bachelor’s degree in engineering.

5.15.2 Curriculum

The curriculum must meet the following requirements：

a） Basic skills training for geological field work and engineering technology，including essential geological and engineering teaching practice and professional practice，and the field teaching time for essential geological，and engineering teaching practice should be no less than 5 weeks;

b) To train students to use the basic concepts, principles and analysis methods of geology and engineering to observe, analyze and describe the geological phenomena in the field, and master the methods and techniques for solving engineering problems in geology;

c) The schedule for the professional practice session is no less than 5 weeks, have field, site, and indoor workloads, and a design/thesis is formed to cultivate students' ability to solve geological engineering problems.

5.15.3 Faculty

The faculty must meet the following requirements:

a) The faculty members engaged in the teaching of professional courses have at least one stage in their learning experience with a professional degree in geology;

b) More than 80% of faculty members engaging in professional teaching work have accumulated experience in geological enterprises or engineering practice (including corporate work or completion of engineering projects and applied research projects) for at least one year.

5.16 Complementary criteria for Textile and Similarly Named Engineering Programs

5.16.1 Applicable programs

The complementary program criteria apply to textile programs such as textile engineering, fashion design and engineering, and non-woven materials and engineering, which are established in accordance with the relevant regulations of the Ministry of Education to award a bachelor's degree in engineering.

5.16.2 Curriculum

The curriculum must meet the following requirements:

a) Students are able to master the knowledge set of textile materials science that reveals the composition, structure, morphological characteristics, performance evolution and laws of fibers and their aggregates;

b) Students are able to master the knowledge of textile engineering covering the whole textile production chain and the whole life cycle control;

c) Students are able to master the knowledge set of textile product design that considers the unity of science and technology and humanistic attributes, art and function, and master the knowledge of textile management that integrates information, economy, society and other elements from design, manufacturing to sales;

d) Students are able to comprehensively apply the above knowledge and principles, solve complex engineering problems in transforming fiber and fiber aggregate from raw material state to product state, and pay attention to the high efficiency, refinement and human and environmental friendliness of manufacturing process.

5.16.3 Faculty

The faculty must meet the following requirements:

a) More than 70% of faculty members engaging in professional teaching work have at least one stage in their learning experience with a degree in textile;

b) More than 80% of faculty members have at least 6 months of engineering experience in textile or related enterprises.

5.17 Complementary criteria for Nuclear and Similarly Named Engineering Programs

5.17.1 Applicable programs

These complementary program criteria apply to nuclear engineering related programs established in accordance with the regulations of the Ministry of Education to award a bachelor's degree in engineering.

5.17.2 Curriculum

The curriculum must meet the following requirements:

a） Courses cover at least one of the following fields of knowledge： Theoretical mechanics，quantum mechanics，electrodynamics，statistical mechanics，fluid mechanics，thermodynamics，radio-chemistry and chemical engineering principles；

b） Courses that enable students to master the fundamental knowledge of nuclear physics，radiation detection，radiation protection，and have the corresponding experimental ability，and abilities in information technology，electrical and electronic technology and engineering drawing；

c） Professional courses reflecting the nuclear safety culture；

d） Graduation design（thesis），in which different projects are provided to each student.

5.17.3 Faculty

The faculty must meet the following requirements：

a） The faculty members of professional courses have educational qualifications or other education experience in nuclear engineering or nuclear physics，or work experience in nuclear engineering related enterprises/institutes；

b） More than 80% of faculty members engaging in professional teaching（including professional experiment teaching）have accumulated engineering practice experience in relevant enterprises or institutes for at least half a year；

c) No more than 50% of full-time faculty members are permitted to be counted in other accredited programs.

5.17.4 Supporting resources

The university/college to which the program belongs must qualify and license to engage in radioactive work.

5.18 Complementary criteria for Civil and Similarly Named Engineering Programs

5.18.1 Applicable programs

These complementary program criteria apply to civil engineering programs established in accordance with the regulations of the Ministry of Education to award a bachelor's degree in engineering.

5.18.2 Curriculum

The curriculum must meet the following requirements:

a) Upon graduation, students can apply the basic principles and methods of engineering mechanics, structural mechanics, fluid mechanics, engineering materials, engineering survey, engineering drawing, engineering economy, etc.;

b) Students understand the core concepts and professional technologies of the design, construction, operation and maintenance, and management of civil engineering facilities or systems;

c） Students are able to identify，express，analyze and solve complex civil engineering problems by comprehensively using wide-ranging professional knowledge and skills.

5.18.3 Faculty

The faculty must meet the following requirements：

a） The faculty members of professional courses（including practical courses）have at least one stage of their learning experience with a degree in civil engineering-related majors；

b） The faculty members of professional main/core courses（including practical courses）have related engineering practice experience；

c） The faculty members of professional courses have a clear and stable research direction；

d） Each faculty member guide no more than 8 students who undertake the final year project every year.

5.18.4 Supporting resources

Current engineering construction laws and regulations，national standards，industry standards and engineering atlas that meet the teaching needs，professional software necessary for course teaching and graduation design，and relatively stable off-campus professional practice bases，must be available.

5.19 Complementary criteria for Energy and Power and Similarly Named Engineering Programs

5.19.1 Applicable programs

These complementary program criteria apply to programs in energy and power such as Energy and Power Engineering，Energy and Environmental System Engineering，New Energy Science and Engineering，Energy Storage Science and Engineering，Energy Service Engineering，Hydrogen Energy Science and Engineering，and Sustainable Energy，which are established in accordance with the regulations of the Ministry of Education to award a bachelor's degree in engineering.

5.19.2 Curriculum

The curriculum must meet the following requirements：

a） Natural science courses include the knowledge of physics，chemistry（or life science），etc.；

b） Courses on engineering foundation requisite include the knowledge of mechanical design，engineering mechanics，electrical and electronic technology，computer application，control engineering and environmental engineering，etc.；

c） Engineering science courses and engineering technology courses can be set up based on the academic advantages and characteristics of each school or institute，and include knowledge fields such as engineering thermodynamics，fluid mechanics，heat transfer（or combustion science），thermal energy and power engineering testing technology, and other essential knowledge fields closely related to the majors set up;

d) Practices include experiments in the laboratory, innovation and entrepreneurship training, project design, enterprise or field internship, etc.. The graduation project (thesis) is carried out around engineering, in which research and design should be involved with a certain degree of comprehensiveness and complexity.

5.19.3 Faculty

Each faculty member of engineering technology courses must have an academic degree in the major and related engineering majors, or have over 2 years' experience in design, R&D, engineering or management practice in energy and power-related enterprises and research institutions, and are well-informed of the latest development of science and technology in the energy and power branch of engineering.

5.20 Complementary criteria for Light Industry and Similarly Named Engineering Programs

5.20.1 Applicable programs

These complementary program criteria apply to light industry programs, such as Light Chemical Engineering, Packaging Engineering, Printing Engineering, Flavor and Fragrance Technology and Engineering, Cosmetics Technology and Engineering, and Biomass Energy and Materials, which are established in accordance with the relevant regulations of the Ministry of education to award a bachelor's degree in engineering.

5.20.2 Curriculum

The curriculum must meet the following requirements:

a) Ensure that students of this major have the engineering foundation of mathematics, natural science, engineering science principles and experimental methods, professional knowledge, etc. when they graduate;

b) Ensure that the practical teaching system can combine the actual engineering problems and needs of the light industry, carry out engineering practice training, strengthen engineering awareness and provide engineering practice experience;

c) The teaching contents of the courses are constantly improved with the times to meet the needs of social progress and scientific and technological development for light industry talents.

5.20.3 Faculty

The faculty must meet the following requirements:

a) The faculty members of professional core courses have enterprise work experience or experience in relevant engineering practice and research, and understand the latest development of science and technology in the field of their major;

b） The training plan for young faculties engineering ability and teaching ability have been formulated.