

课程名称：工程制图 I（2）

课程编码：7033402

课程学分：2 学分

课程学时：32 学时

适用专业：机械设计制造及其自动化

工程制图 I（2）

（Engineering Drawing I（2））

教学大纲

1. 课程性质与任务

本课程为本科四年制机械设计制造及其自动化专业的重要专业必修课《工程制图 I（1）》的后续课程，其主要任务是进一步学习机械制图国家标准和有关规定，掌握较复杂零件图的绘制和识读、较复杂装配体装配图的绘制和识读，培养技术实践意识，培养态度认真、作风严谨的独立工作能力，为学生继续深入学习后续专业基础课和专业课的重要基础。本课程同时培养学生追求真理、实事求是、勇于探索的科学精神以及终身学习的能力，为今后从事机械设计及制造工作、提升我国装备制造业水平、培养合格的新时代社会主义事业建设高素质人才奠定良好的基础。

2. 课程教学目标与达成途径

表 1 课程教学目标与其支撑的毕业要求指标点

序号	教学目标	支撑的毕业要求指标点
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1	教学目标 1: 进一步巩固制图基础知识。学习和掌握标准件和常用件、零件图及装配图的基本知识,能够应用视图、剖视图等制图表达方法对较复杂的零件和装配体(多于 20 件零件)进行读图和手工绘图。	指标点 1.2: 掌握工程基础知识,并结合数学及自然科学知识,能够将其应用于机械工程问题解决方案的分析与综合。
2	教学目标 2: 能够使用一种常用工具软件熟练绘制并打印较复杂的零件图和装配图。	指标点 5.3: 能够合理开发和选择工程软件以及计算机程序设计语言等现代工具,正确模拟与预测复杂机械工程问题,并分析其局限性。
3	教学目标 3: 培养独立分析问题的能力和严谨的工作态度。培养学生独立分析问题、解决问题和协同工作的能力,培养认真负责的工作态度和严谨细致的工作作风,增强工程标准化意识。	指标点 1.2: 掌握工程基础知识,并结合数学及自然科学知识,能够将其应用于机械工程问题解决方案的分析与综合。
		指标点 5.3: 能够合理开发和选择工程软件以及计算机程序设计语言等现代工具,正确模拟与预测复杂机械工程问题,并分析其局限性。
		指标点 8.3: 理解机械工程师的职业性质和社会责任,能够在机械工程实践活动中履行责任。

表 2 课程所支撑的毕业要求指标点的达成途径

所支撑的毕业要求 指标点	支撑 强度	课程教 学目标	达成途径
标点 1.2: 掌握工程基础知识,并结合数学及自然科学知识,能够将其应用于机械工程问题解决方案的分析与综合。	H	课程教学 目标 1、3	<p>课堂讲授: 重点突出、思路清晰、师生互动、边讲边练,及时掌握学生学习情况。</p> <p>案例讨论: 以小组为单位,讨论较复杂零件图、装配图的最佳表达方案等,并通过各组间的相互讲解和质疑,进一步加深学生对制图国家标准和行业习惯的理解和掌握。</p> <p>手工绘图: 针对零件图、装配图等内容,选择典型案例进行手工白图绘制练习,帮助学生在应用中加深对该内容的理解和掌握。</p> <p>课堂测验: 以测试卷的形式,检测对标准件、公差、配合、表面结构、规定画法、查表等内容的理解和掌握情况,根据答题情况查漏补缺,改进教学。</p> <p>课后作业: 每次课后都留巩固学习内容的课后作业,全批全改,下次课前首先利用 ppt 讲解上次作业中存在的问题及其正确的解答方法。课间和课后可针对个性问题做解答,供学</p>

			生进一步巩固学习。
指标点 5.3: 能够合理开发和选择工程软件以及计算机程序设计语言等现代工具,正确模拟与预测复杂机械工程问题,并分析其局限性。	H	课程教学目标 2、3	<p>课堂讲授: 重点突出、思路清晰地讲解使用工具软件绘图的主要思路和方法。</p> <p>视频学习: 针对软件中如何调用各种标准件、绘制较复杂零件图、装配图的过程、方法以及各种技巧教师都自制了视频,供学生反复查看学习。</p> <p>课堂上机: 在课堂讲授和视频学习的基础上,完成各种标准件调用、较复杂零件图和装配图的绘制,掌握正确出图的方法,并根据学生的问题,进行个性化指导。</p> <p>课后作业: 至少用工具软件绘制 3 张较复杂典型零件的零件图和 2 套完整的装配图,熟练软件操作技能,巩固制图基本知识。</p>
指标点 8.3: 理解机械工程师的职业性质和社会责任,能够在机械工程实践活动中履行责任。	H	课程教学目标 3	<p>课堂讲授: 在课堂讲授中,强调国家标准在工程图中的具体表现及其重要意义。</p> <p>手工和上机绘图: 通过手工和上机绘图,深刻体会国家标准与规定在制图中的具体表现,理解遵守职业规范的重要性,培养责任感。</p> <p>课后作业: 每一部分内容讲解完后都要留巩固学习内容的课后作业,巩固各种制图国标知识,全批全改、及时反馈。</p>

3. 教学基本内容及基本要求

表 3 课程教学内容及要求

序号	教学内容	教学要求	学时	对应的教学目标
1	1 零件图 (二) 1.1 零件的技术要求 1.2 看零件图方法的方法和步骤 1.3 画零件图的方法和步骤 1.4 典型零件图例分析 1.5 零件的测绘	<p>掌握: 表面粗糙度、极限与配合、几何公差等技术要求的标注方法; 典型零件的图样画法; 读画零件图的方法和步骤; 零件测绘方法。</p> <p>课堂练习: 练习表面结构、极限与配合公差等的标注及查表方法。习题册: P50-1(1), P50-2(1), P51-1, P51-3</p> <p>课后作业: 巩固表面结构、极限与配合、公差等的查表及标注方法。P50-1(2), P50-2(2), P51-2, P51-4, 根据已知视图, 读懂零件结构, 并补画其他视图 P52-1、2。</p>	6	1, 3
2	2 手工绘制零件图 2.1 测绘支座零件 2.2 绘制零件图	<p>手绘草图: 分配支座模型, 对支座零件的内外结构形状进行测绘, 绘制完整、准确、清晰的</p>	手绘 4	1, 3

序号	教学内容	教学要求	学时	对应的教学目标
		草图。 手绘白图: 手工绘制零件白图: P53、P55		
3	3 SolidWorks 零件图绘制 3.1 各种剖视图的绘制方法 3.2 零件图的绘制方法	了解: SolidWorks 视图布局中各选项含义。 掌握: 多剖切平面剖面视图、断开的剖视图等常用选项的使用方法; 掌握各种形式的基本尺寸、尺寸公差和几何公差的标注方法; 掌握对文件属性的修改方法; 掌握零件图的正确出图方法。 课堂练习: 一步步跟练老师课堂上讲解的内容, 进行实际操作, 每小组共同学习, 各小组所有成员均顺利完成操作后整个小组进入下一环节操作。 课后作业: 机绘常用轴类零件、盘盖类零件的零件图。P52-1、P52-2 视频学习: 课下自学自制视频中有关各标准件的表达部分	上机 4	1, 2, 3
4	4 标准件和常用件 4.1 螺纹紧固件 4.2 键 4.3 销 4.4 滚动轴承 4.5 弹簧 4.6 齿轮	了解: 标准件和常用件的区别 掌握: 螺纹紧固件的种类及用途、画法及标记方法; 螺纹紧固件连接的画法; 螺纹紧固件标准查询方法; 键、销、轴承、弹簧及齿轮的标记方法和规定画法。 课后作业: 绘制螺纹紧固件两视图, 绘制螺纹紧固件连接的视图: 练习册 P57-2, P58-1, 键、销、轴承、齿轮的画法及标记方法: P60-1-2、P61-1-2。	4	1, 3
5	5 SolidWorks 标准件表达 5.1 螺纹表达 5.2 齿轮表达 5.3 轴承表达	了解: SolidWorks 设计库的各项含义及基本使用方法 掌握: SolidWorks 对螺纹紧固件的调用方法, 螺纹的添加方法, 螺纹连接的视图生成及处理方式; SolidWorks 对键、销的调用方法; 对轴承、齿轮的调用方法及压缩特征并按国家标准出图的方法; 齿轮啮合的表达方法。 课堂练习: 一步步跟练老师课堂上讲解的内容, 进行实际操作, 每小组共同学习, 各小组所	上机 2	1, 2, 3

序号	教学内容	教学要求	学时	对应的教学目标
		<p>有成员均顺利完成操作后整个小组进入下一环节操作。</p> <p>课后作业: 对课堂上的操作进行复习,脱离老师的带领自行练习有关内容</p> <p>视频学习: 课下自学自制视频中有关各标准件的表达部分</p>		
6	<p>6 装配图</p> <p>6.1 装配图的内容</p> <p>6.2 装配图的规定画法和特殊画法</p> <p>6.3 装配图的尺寸标注、零件编号、明细表及技术要求</p> <p>6.4 配合尺寸与装配结构的合理性</p> <p>6.5 画装配图的方法和步骤</p> <p>6.6 看装配图的方法和步骤</p> <p>6.7 由装配图拆画零件图</p>	<p>了解: 常见的装配结构及其合理性;</p> <p>掌握: 较复杂装配体其装配图内容、常用表达方法和视图选择、尺寸标注、零件序号与明细栏的编排方法;画装配图的方法;读装配图和拆画零件图的方法。</p> <p>课堂练习: 练习轴与齿轮键连接其装配图的绘制及标注方法。习题册: P63</p>	6	1, 3
7	<p>7 装配图绘制练习</p> <p>7.1 手工绘制装配图</p> <p>7.2 由装配图拆画零件图</p>	<p>手绘白图:</p> <p>1、 绘制千斤顶的装配图。P66</p> <p>2、 拆画车阀盖小头夹具装配图中夹具体的零件图。P74</p>	手绘 4	1, 3
8	<p>8 SolidWorks 装配图绘制</p> <p>8.1 装配图一组视图的创建</p> <p>8.2 各种注解的添加方法</p>	<p>了解:装配图的创建步骤及命令。</p> <p>掌握:视图的创建; 尺寸标注及其公差配合; 零件序号、明细表等常用注解的添加及编辑方法; 装配图的正确出图方法。</p> <p>课堂练习: 一步步跟练老师课堂上讲解的内容,进行实际操作,每小组共同学习,各小组所有成员均顺利完成操作后整个小组进入下一环节操作。</p> <p>课后作业: 机绘机用虎钳装配图。P67</p> <p>视频学习: 课下自学自制视频中有关各标准件的表达部分。</p>	上机 2	1, 2, 3

4. 教学方式

探索和改进教学方法,提倡启发式、讨论式、案例式教学,突出对学生工程应用能力和国标意识的培养。具体教学方式如下:

1) 基础知识以课堂讲授为主，软件操作辅以自制视频。对基础知识，课堂讲授采用多媒体教学，注重结合生产实际的案例，进行讨论教学。对软件的学习，要求学生课下首先自学自制视频，熟悉各命令、界面操作，课堂上一步步跟着老师实操，较扎实掌握所讲授内容。

2) 课堂小组合作练习。课堂讲授的同时，针对核心知识点安排课堂练习。小组对练习内容进行讨论，有助于进一步发现问题和深入理解。软件实操环节，小组成员之间相互提醒，相互帮助和辅导，所有成员均完成一段操作后，教师才讲解后续内容。小组成员互助可加快课堂进度，提高课堂效率。

3) 课后作业。每节课后均会布置课后作业，以教材对应的练习册上的习题为主，全批全改，下次课前首先讲解上次作业中出现的问题，并给出正确答案，供学生进一步查阅学习。

4) 手绘白图。在轴测图的学习环节，选择基本组合体进行手工绘白图练习，帮助学生掌握使用等轴测图表达零件的方法；在零件图和装配图的学习环节，选择典型零件和装配体进行手工白图绘制练习，并由装配图进行零件图的拆画。这种练习具有一定综合性，帮助学生在应用中掌握绘图基本知识并践行绘图细节中的国标，培养学生认真负责的工作态度和严谨细致的工作作风，帮助其养成自觉遵守有关制图的国家标准和规定的习惯。

5) 上机绘图。在零件图、装配图的学习环节，要求学生课下自学自制的软件操作教学视频，同时安排多次课内上机进行个性化指导。在这个环节会要求学生小组内合作，完成装配体中多个零件三维实体的创建并分享给其他成员用于创建装配体进而绘制装配图。学生在此环节分工合作，共同完成较复杂装配体的创建，并自行绘制装配图，培养了其解决复杂工程问题的能力。

5. 教材及教学参考书

教材：

- 1) 大连理工大学工程图学教研室 编，机械制图（第7版），高等教育出版社，2016年
- 2) 大连理工大学工程图学教研室 编，机械制图习题集（第6版），高等教育出版社，2018年

参考书：

何铭新 钱可强主编，机械制图（第6版），高等教育出版社，2010年

钱可强 主编，机械制图习题集（第4版），高等教育出版社，2016年

6. 学生成绩评定方法

本课程以考核学生能力培养目标的达成为主要目的，以检查学生对各知识点的掌握程度以及应用为重要内容。能力目标达成评价与考核总成绩中，期末考试成绩占30%，平时考查（包括平时手绘习题册作业和白图、机绘作业）占70%。

具体要求如下：

1) 课程评分类型：百分制。

2) 结课考核方式：闭卷，重点考察知识应用能力。

3) 课程总成绩评定：平时成绩（手绘习题册作业和白图、机绘作业）占总成绩的70%，期末考试占总成绩的30%。

表 4 课程教学目标评价矩阵

成绩组成	考核/评价环节	分值	考核/评价细则	对应的课程目标
平时成绩 70%	手绘作业	30	通过手工绘制习题册作业和白图,考核学生对每节课知识点的复习、理解和掌握程度。	1 3
	机绘作业	40	通过计算机绘图考核学生创建复杂装配体、复杂零件的零件图、复杂装配体的装配图的能力。	2 3
期末考试 30%	期末考试卷面成绩	30	考试题以作图题为主,考察读图和绘图能力,配合选择填空题,考察学生对制图标准及基本概念的理解。	1 3

表 5 《工程制图 I-2》平时成绩评价标准

教学 目标 1	进一步巩固制图基础知识。学习和掌握标准件和常用件、零件图及装配图的基本知识,能够应用视图、剖视图等制图表达方法对较复杂的零件和装配体(多于 20 件零件)进行读图和手工绘图。	
评分 标准	90-100	能够掌握相关国家标准,掌握标准件的正确画法,掌握工程图尺寸标注与各种技术要求(极限、配合、几何公差及表面结构等)的相关基础知识和标注方法,掌握各种国家标准的查询方法,能清晰、简洁地表达复杂零件和装配体,并能在绘图过程中贯彻相关国家标准。 手绘习题册作业和白图表达方案合理,尺寸和各项技术要求的数值查询正确,标注符合国家标准,字迹工整,图面干净整洁,基本概念与相关知识理解无误。
	75-89	能够掌握相关国家标准,掌握标准件的正确画法,掌握工程图尺寸标注与各种技术要求(极限、配合、几何公差及表面结构等)的相关基础知识和标注方法,掌握各种国家标准的查询方法,能比较清晰、简洁地表达复杂零件和装配体,并能在绘图过程中贯彻常用的相关国家标准。 手绘习题册作业和白图表达方案基本正确,个别尺寸和技术要求的数值查询或标注不符合国家标准,字迹较工整,图面较干净整洁,基本概念与相关知识理解有少量

		错误。
	60-75	能够掌握相关国家标准，基本掌握标准件的正确画法、工程图尺寸标注与各种技术要求（极限、配合、几何公差及表面结构等）的相关基础知识和标注方法、各种国家标准的查询方法，能比较合理地表达较复杂零件和装配体，有较多不符合国家标准之处。 手绘习题册作业和白图表达方案错误较多，尺寸和各项技术要求的数值查询有多处错误，字迹潦草，图面较乱，擦涂痕迹明显，基本概念与相关知识理解有一定错误。
	0-59	掌握部分相关国家标准，掌握少量标准件的正确画法、工程图尺寸标注与各种技术要求（极限、配合、几何公差及表面结构等）的相关基础知识和标注方法，掌握常用国家标准的查询方法，不能合理地表达较复杂零件和装配体。 手绘习题册作业和白图表达错误很多，字迹潦草不可辨，图面较乱，擦涂痕迹明显，基本概念与相关知识理解有大量错误。
教学 目标 2	能够使用一种常用工具软件熟练绘制并打印较复杂的零件图和装配图。	
评 分 标 准	90-100	能够进行复杂装配体的创建，配合关系合理，符合使用习惯。能够对复杂零件和装配体进行出图，布局合理，比例合适，表达方案简洁清晰，各种标注符合国家标准要求。文档属性设置合理。
	75-89	能够进行复杂装配体的创建，配合关系合理，符合使用习惯。能够对复杂零件和装配体进行出图，布局较合理，比例合适，表达方案简洁清晰，各种标注基本符合国家标准要求。文档属性大部分设置正确、合理，符合国家标准，个别有误。
	60-75	能够进行较复杂装配体的创建，配合关系基本合理，基本符合使用习惯。能够对较复杂零件和装配体进行出图，表达方案选择欠合理，绘制错误较多，文档属性设置多处不符合国家标准。
	0-59	能够进行简单装配体的创建。能直接从三维模型导出二维图，不能进行编辑修改，表达方案不合理，不符合读图习惯和国家标准。
教学目 标 3	培养独立分析问题的能力和严谨的工作态度。培养学生独立分析问题、解决问题和协同工作的能力，培养认真负责的工作态度和严谨细致的工作作风，增强工程标准化意识。	
评	90-100	学习态度端正，作业认真，能够正确选择和查询国家标准，绘图遵守国家标准。

分 标 准	75-89	学习态度端正，作业较认真，能够基本正确地选择和查询国家标准，绘图基本遵守国家标准。
	60-75	学习态度较端正，对国家标准的选择和查询有一定错误，作业有多处不符合国家标准。
	0-59	学习态度不端正，不会选择和查询国家标准，作业不符合国家标准。

7. 课程教学目标达成度评价依据与方法

1) 教师自评

任课教师依据课程教学目标的支撑环节进行达成度评价，具体方法见表5《工程制图 I (2)》课程教学目标达成度评价表，达成度评价目标值为 0.7，达成度结果低于 0.7 的教学目标为未达成。

2) 学生问卷调查

课程结课并提交成绩后，机械与材料工程学院教学委员会组织学生对课程教学目标情况通过问卷调查进行达成评价（见表 6），并进行数据统计与分析。

表 6《工程制图 I (2)》课程教学目标达成度评价表

课程编号：7033402 学期： 班级： 人数： 教师：

课程目标支撑环节	平时 (70%)		期末考试成绩 (30 %)			课程 总评成绩 (100%)
	手绘作业	机绘作业	课程目标 1	课程目标 2	课程目标 3	
学生平均得分						
目标分值	30	40	25	0	5	100
课程目标			评价内容	目标分值	平均得分	达成度结果
课程教学目标 1. 进一步巩固制图基础知识。学习和掌握标准件和常用件、零件图及装配图的基本知识，能够应用视图、剖视图等制图表达方法对较复杂的零件和装配体（多于 20 件零件）进行读图和手工绘图。			手绘作业	30		$\frac{\sum \text{平时平均得分}}{\sum \text{平时目标分值}} \times 0.7$ $+ \frac{\text{目标1平均得分}}{70} \times 0.3$
			试卷课程目标 1	25		

课程教学目标2. 能够使用一种常用工具软件熟练绘制并打印较复杂的零件图和装配图。	机绘作业	40		$\frac{\sum \text{平时平均得分}}{\sum \text{平时目标分值}} \times 0.7$
课程教学目标3. 培养独立分析问题的能力和严谨的工作态度。培养学生独立分析问题、解决问题和协同工作的能力，培养认真负责的工作态度和严谨细致的工作作风，增强工程标准化意识。	平时总作业	70		$\frac{\sum \text{平时平均得分}}{\sum \text{平时目标分值}} \times 0.7$
	试卷课程目标3	30		$\frac{\text{目标3平均得分}}{30} \times 0.3$
课程教学目标总体达成度		100		总评平均分/100
此次考核普遍存在的问题及原因分析	<p>1. 问题:</p> <p>2. 原因分析:</p>			
持续改进意见				

表7 《工程制图 I (1)》课程教学目标达成情况问卷

序号	课程教学目标	通过本课程的学习，我达成了课程教学目标				
		完全同意	同意	基本同意	不同意	完全不同意
1	课程教学目标1. 进一步巩固制图基础知识。学习和掌握标准件和常用件、零件图及装配图的基本知识，能够应用视图、剖视图等制图表达方法对较复杂的零件和装配体（多于20件零件）进行读图和手工绘图。					
2	课程教学目标2. 能够使用一种常用工具软件熟练绘制并打印较复杂的零件图和装配图。					
3	课程教学目标3. 培养独立分析问题的能力和严谨的工作态度。培养学生独立分析问题、解决问题和协同工作的能力，培养认真负责的工作态度和严谨细致的工作作风，增强工程标准化意识。					

8. 毕业要求指标点达成度评价依据与方法

本课程支撑的毕业要求指标点达成度评价依据：1) 支撑毕业要求指标点的课程教学目标（表 1）及达成途经（表 2）；2) 各教学目标达成度评价结果（表 6）。毕业要求指标点达成度评价方法见表 8，多个教学目标支撑同一指标点的权重依据各教学目标对指标点的支撑程度并参考期末试卷各目标分值确定。

表 8 毕业要求指标点达成度评价表

指标点	教学目标	目标达成度 d_i	权重 ω_i	指标点达成度评价方法
1.2	教学目标 1		0.8	评价值=目标值 $\times\sum d_i\times\omega_i$
	教学目标 3		0.2	
5.3	教学目标 2		0.8	评价值=目标值 $\times\sum d_i\times\omega_i$
	教学目标 3		0.2	
8.3	教学目标 3		1.0	评价值=目标值 $\times\sum d_i\times\omega_i$

9. 本课程与其它相关课程的联系与分工

先修课程：工程制图 I（1）。

后续课程：制图实践，机械原理，机械设计，互换性测量技术基础，毕业设计等。

10. 其它类别问题的说明

任课教师可根据学生掌握情况，对内容和学时分配做适当调整。

大纲撰写人：李功一

大纲审阅人：刘 瑛

系 负 责 人：刘 瑛

学院负责人：张若青

修订日期：2020年4月

Course Title: Engineering Drawing I (2)

Course code: 7033402

credits: 2

contact hours: 32

major: Mechanical design, manufacturing and automation

Engineering Drawing I (2)

The syllabus

1. Course nature and tasks

This course for undergraduate four-year mechanical design and manufacturing and its automation is an important professional required course of engineering drawing I (1) the follow-up courses, its main task is to further study mechanical drawing standards and the relevant provisions of the state, to master the complex part drawing to draw and read, the more complex assembly body assembly drawing and read, cultivating technology practice consciousness, Cultivate the ability to work independently with serious attitude and rigorous style, which is an important foundation for students to further study the follow-up basic professional courses and specialized courses. At the same time, this course cultivates students' scientific spirit of pursuing truth, seeking truth from facts, daring to explore and lifelong learning ability, which lays a good foundation for their future work in mechanical design and manufacturing, improving the level of China's equipment manufacturing industry, and cultivating qualified high-quality talents for socialist cause construction in the new era.

2. Teaching objectives and approaches

Table 1 Course teaching objectives and supporting graduation requirements index points

The serial number	The teaching goal	Supporting graduation requirement index points
1	<p>Objective 1: to further consolidate the basic knowledge of cartography. Learn and master basic knowledge of standard parts and common parts, part drawings and assembly drawings, and be able to read and draw drawings of complex parts and assemblies (more than 20 parts) by using drawing expression methods such as view and section view.</p>	<p>Indicator Point 1.2: Master basic engineering knowledge, combined with mathematics and natural science knowledge, able to apply it to the analysis and synthesis of mechanical engineering problem solutions.</p>
2	<p>Objective 2: Be able to skillfully draw and print complex parts and assembly drawings using a common tool.</p>	<p>Indicator Point 5.3: Able to reasonably develop and select modern tools such as engineering software and computer programming language, correctly simulate and predict complex mechanical engineering problems, and analyze their limitations.</p>
3	<p>Objective 3: Develop the ability to analyze problems independently and develop a rigorous work attitude. Cultivate students' ability to analyze problems independently, solve problems and work cooperatively, cultivate serious and responsible working attitude and rigorous and meticulous working style, and enhance the awareness of engineering standardization.</p>	<p>Indicator Point 1.2: Master basic engineering knowledge, combined with mathematics and natural science knowledge, able to apply it to the analysis and synthesis of mechanical engineering problem solutions.</p> <p>Indicator Point 5.3: Able to reasonably develop and select modern tools such as engineering software and computer programming language, correctly simulate and predict complex mechanical engineering problems, and analyze their limitations.</p> <p>Indicator point 8.3: Understand the professional nature and social responsibilities of mechanical engineers, and be able to fulfill responsibilities in mechanical engineering practice activities.</p>

Table 2 Ways to achieve the graduation requirement index points supported by the course

Supported by graduation requirements Index point	support The intensity of	Teaching Objectives of the course	A way to
Punctuation 1.2: Master basic engineering knowledge, combined with mathematics and natural science knowledge, able to apply it to the analysis and synthesis of mechanical engineering problem solutions.	H	Course teaching Objectives 1, 3	<p>Classroom teaching: focus, clear thinking, interaction between teachers and students, practice while speaking, timely grasp the learning situation of students.</p> <p>Case discussion: discuss the best expression scheme of complex parts drawing and assembly drawing in groups, and further deepen students' understanding and mastery of national drawing standards and industry practices through mutual explanation and questioning among groups.</p> <p>Manual drawing: for parts drawing, assembly drawing and other content, select typical cases for manual drawing practice, help students to deepen their understanding and mastery of the content in the application.</p> <p>Classroom test: in the form of test papers, test the understanding and mastery of standard parts, tolerances, coordination, surface structure, prescribed drawing method, look up tables, etc., according to the answers, check and fill the gaps, improve teaching.</p> <p>Homework: every time after class to consolidate the learning content of homework homework, all batch and change, before the next class, first use PPT to explain the problems in the last homework and the correct solution. During and after class, students can solve the personality problems for further consolidation of learning.</p>
Indicator Point 5.3: Able to reasonably develop and select modern tools such as engineering	H	Course teaching Objectives 2 and 3	<p>Classroom teaching: highlight and clearly explain the main ideas and methods of drawing using software tools.</p> <p>Video learning: for how to call various standard parts, draw more complex parts drawing, assembly drawing</p>

<p>software and computer programming language, correctly simulate and predict complex mechanical engineering problems, and analyze their limitations.</p>			<p>process, methods and various skills in the software, teachers have made videos for students to repeatedly review and learn.</p> <p>Computer in class: on the basis of classroom teaching and video learning, complete the drawing of various standard parts, more complex parts drawing and assembly drawing, master the method of drawing correctly, and give personalized guidance according to students' questions.</p> <p>Homework: Draw at least 3 parts drawings of complex typical parts and 2 sets of complete assembly drawings with software tools, master software operation skills and consolidate basic drawing knowledge.</p>
<p>Indicator point 8.3: Understand the professional nature and social responsibilities of mechanical engineers, and be able to fulfill responsibilities in mechanical engineering practice activities.</p>	H	<p>Course teaching Objective 3</p>	<p>Classroom teaching: in classroom teaching, emphasize the concrete performance and significance of national standards in engineering drawings.</p> <p>Manual and computer drawing: through manual and computer drawing, deeply understand the specific performance of national standards and regulations in drawing, understand the importance of complying with professional norms, and develop a sense of responsibility.</p> <p>Homework: after each part of the content is explained, homework should be left to consolidate the learning content, consolidate the knowledge of all kinds of drafting gb, complete revision, timely feedback.</p>

3. Basic contents and requirements of teaching

Table 3 Teaching content and requirements

No.	The teaching content	Teaching requirements	Cont act hour	Correspo nding teaching objectiv es
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No.	The teaching content	Teaching requirements	Cont act hour	Correspo nding teaching objectiv es
1	1 Parts Drawing (II) 1.1 Technical requirements of parts 1.2 Methods and steps of the part drawing method 1.3 Methods and steps for drawing part drawings 1.4 Legend analysis of typical parts 1.5 Parts mapping	Master: marking methods of surface roughness, limit and fit, geometric tolerance and other technical requirements; The drawing method of typical parts;Methods and steps of reading and drawing parts drawings;Part mapping method. Classroom exercises: practice the marking and look-up method of surface structure, limit and fit tolerance. Problem sets: P50-1 (1), P50-2 (1), P51-1, P51-3 Homework: consolidation of surface structure, limit and fit, tolerance, etc. Table lookup and marking methods. P50-1 (2), P50-2 (2), P51-2, P51-4, according to the known view, understand the structure of parts, and complement other views P52-1 and 2.	6	1, 3
2	2. Draw part drawing manually 2.1 Mapping support parts 2.2 Drawing parts	Hand-drawn sketch: assign the bearing model, map the internal and external structure shapes of the bearing parts, and draw complete, accurate and clear sketches. Hand-drawn white drawing: hand-drawn white drawing of parts: P53, P55	Hand draw 4	1, 3
3	SolidWorks parts drawing 3.1 Drawing methods of various sectional views 3.2 Part drawing method	Understanding :SolidWorks view layout options meaning. Master the use of common options such as multi-section plane section view and disconnected section view;Master the	Compu ter 4	1, 2, 3

No.	The teaching content	Teaching requirements	Cont act hour	Correspo nding teaching objectiv es
		<p>marking methods of basic dimensions, dimensional tolerances and geometric tolerances in various forms; Master the modification method of file attributes; Master the correct drawing method of parts drawing.</p> <p>Classroom practice: step by step to practice the content explained by the teacher in class, carry out practical operation, each group study together, after all the members of each group successfully complete the operation, the whole group enters the next link operation.</p> <p>Homework: machine drawing commonly used shaft parts, disk cover parts of the parts. P52-1, P52-2</p> <p>Video learning: self-study the expression of standard parts in self-made videos after class</p>		
4	<p>4 Standard parts and common parts</p> <p>4.1 Threaded Fasteners 4.2 key 4.3 pin 4.4 Rolling bearing 4.5 the spring 4.6 the gear</p>	<p>Understanding: the difference between standard parts and common parts</p> <p>Master: types and uses of threaded fasteners, drawing and marking methods; Drawing of threaded fastener connection; Standard inquiry method for threaded fasteners; Marking method and specified drawing method for keys, pins, bearings, springs and gears.</p> <p>Homework: Drawing two views of threaded fasteners, drawing views of threaded</p>	4	1, 3

No.	The teaching content	Teaching requirements	Cont act hour	Correspo nding teaching objectiv es
		fasteners connection: Workbook P57-2, P58-1, drawing and marking methods of keys, pins, bearings and gears: P60-1, P61-1-2.		
5	<p>5 SolidWorks standard parts expression</p> <p>5.1 Thread Expression</p> <p>5.2 Gear Expression</p> <p>5.3 Bearing Expression</p>	<p>Understand: SolidWorks design library meaning and basic use methods</p> <p>Master: SolidWorks call method of thread fastener, thread adding method, thread connection view generation and processing method;SolidWorks key, pin call method;On the bearing, gear call method and compression characteristics and according to the national standard drawing method;Expression of gear meshing.</p> <p>Classroom practice: step by step to practice the content explained by the teacher in class, carry out practical operation, each group study together, after all the members of each group successfully complete the operation, the whole group enters the next link operation.</p> <p>Homework: review the operations in class and practice the relevant content independently from the teacher's guidance</p> <p>Video learning: self-study the expression of standard parts in self-made videos after class</p>	Compu ter 2	1, 2, 3
6	<p>6 assembly drawing</p> <p>6.1 Contents of assembly</p>	Understanding: common assembly structure and its rationality;	6	1, 3

No.	The teaching content	Teaching requirements	Cont act hour	Correspo nding teaching objectiv es
	drawing 6.2 Standard drawing and special drawing of assembly drawing 6.3 Dimensioning, part number, detail list and technical requirements of assembly drawing 6.4 Rationality of fit size and assembly structure 6.5 Methods and steps for drawing assembly drawings 6.6 Methods and steps of viewing assembly drawing 6.7 Disassemble and draw part drawing from assembly drawing	Master: assembly drawing content, common expression method and view selection, dimension marking, part serial number and detail column arrangement method of more complex assembly;The method of drawing assembly drawings;Method of reading assembly drawing and drawing parts drawing. Class exercise: practice the drawing and marking method of assembly drawing of shaft and gear key connection. Problem set: P63		
7	Assembly drawing practice 7.1 Manually drawing assembly drawings 7.2 Part drawing is disassembled from assembly drawing	Hand-painted white map: 3、 Draw assembly drawings of jacks.P66 4、 Tear down the painting car valve cover small head fixture assembly diagram clip specific Part drawing.P74	Hand draw 4	1, 3
8	8. SolidWorks assembly drawing 8.1 Assembly Drawing Creation of a set of views 8.2 Adding methods of various annotations	Understanding: assembly drawing creation steps and commands. Master: View creation;Dimension marking and tolerance matching;Adding and editing methods of common notes such as parts serial number and list;Correct drawing method for assembly drawing. Classroom practice: step by step to practice the content explained by the teacher in class, carry out practical operation, each group study together, after all the members of each group	Compu ter 2	1, 2, 3

No.	The teaching content	Teaching requirements	Cont act hour	Correspo nding teaching objectiv es
		<p>successfully complete the operation, the whole group enters the next link operation.</p> <p>Homework: machine drawing machine vise assembly drawing. P67</p> <p>Video learning: self-study the expression of standard parts in self-made videos after class.</p>		

4. Teaching methods

Explore and improve teaching methods, advocate heuristic, discussion, case teaching, highlighting the training of students' engineering application ability and national standard awareness. The specific teaching methods are as follows:

1) Basic knowledge is mainly taught in class, and software operation is supplemented by self-made videos. For basic knowledge, multimedia teaching is adopted in classroom teaching, and discussion teaching is carried out based on practical cases in production. In software learning, students are required to first self-study and make videos after class, be familiar with various commands and interface operations, and follow the teacher step by step in class to master the taught content.

2) Group practice in class. At the same time, arrange classroom exercises for the core knowledge points. The group will discuss the content of the exercise, which will help to further discover the problem and deepen the understanding. In the software practice, group members remind each other, help each other and coach

each other. After all members have completed a section of operation, the teacher will explain the follow-up content. Group members help each other to speed up class progress and improve class efficiency.

3) Homework. After each class, homework will be assigned, mainly based on exercises in the corresponding exercise book of the textbook, and all changes will be made. Before next class, the problems in the last homework will be explained first, and the correct answers will be given for students to further consult and study.

4) Hand-draw white drawings. In the learning part of axonometric drawing, basic assemblies are selected to practice the manual drawing of white drawing to help students master the method of using isoaxonometric drawing to express parts. In the learning part of part drawing and assembly drawing, typical parts and assemblies are selected for manual white drawing practice, and part drawing is disassembled by assembly drawing. This kind of practice is comprehensive to some extent. It helps students master the basic knowledge of drawing and practice the national standards in the details of drawing, cultivates students' serious and responsible working attitude and rigorous and meticulous working style, and helps them form the habit of consciously abiding by the relevant national standards and regulations of drawing.

5) Computer drawing. In the learning links of parts drawing and assembly drawing, students are required to teach themselves the teaching videos of software operation after class, and at the same time arrange for personalized instruction on the computer for many times in class. In this part, students will be required to cooperate within the group to complete the creation of three-dimensional entities of multiple parts in the assembly and share them with other members to create the assembly and draw the assembly drawing. In this part, students work together to complete the creation of complex assembly and draw assembly drawings by themselves, which cultivates their ability to solve complex engineering problems.

5. Teaching materials and reference books

The teaching material:

- 3) Engineering Graphics Department, Dalian University of Technology, Mechanical Drawing (7th edition), Higher Education Press, 2016
- 4) Engineering Graphics Teaching and Research Section, Dalian University of Technology, Mechanical Drawing Problem Sets (6th edition), Higher Education Press, 2018

Reference:

He Mingxin, Qian Keqiang, Mechanical Drawing (6th edition), Higher Education Press, 2010

Qian Keqiang, Mechanical Drawing Problem Sets (4th edition), Higher Education Press, 2016

6. Student achievement evaluation method

The main purpose of this course is to examine the achievement of students' ability training goals, and the important content is to check students' mastery and application of various knowledge points. The final exam score accounts for 30% of the total score of the ability goal achievement evaluation and assessment, and the usual examination (including the usual hand-drawn exercise book and white drawing, machine drawing homework) accounts for 70%.

Specific requirements are as follows:

- 1) Course grading type: 100-point system.
- 2) Assessment method: Close the class, focusing on knowledge application ability.
- 3) Course grade evaluation: The usual grade (hand-drawn problem set, white drawing and machine drawing) will account for 70% of the total grade, and the final exam will account for 30% of the total grade.

Table 4 Evaluation matrix of course teaching objectives

Scores of	Assessment/ evaluation process	score	Assessment/evaluation details	Corresponding course objectives
grades 70%	Hand job	30	Review, understand and master the knowledge points of each lesson by drawing exercise books and white drawings by hand.	1 3
	Machine paint job	40	Test students' ability to create complex assembly, part drawing of complex parts and assembly drawing of complex assembly through computer drawing.	2, 3,
The final exam 30%	Final exam paper score	30	The test questions mainly focus on drawing, and test students' ability to read and draw pictures, as well as their understanding of drawing standards and basic concepts.	1 3

Table 5 Evaluation standard of engineering Drawing I-2

teaching Goal 1	Further consolidate the basic knowledge of cartography. Learn and master basic knowledge of standard parts and common parts, part drawings and assembly drawings, and be able to read and draw drawings of complex parts and assemblies (more than 20 parts) by using drawing expression methods such as view and section view.	
Evaluation of points mark quasi	90-100.	<p>Able to grasp the related national standards, to master the correct standard parts drawing, master the engineering drawing dimensioning and technical requirements (limit, cooperate, geometric tolerance and surface structure, etc.) of the relevant basic knowledge and labeling method, query methods to various kinds of national standard, clearly and concisely express complex parts and assembly, and can implement the relevant national standards in the process of drawing.</p> <p>Hand-painted exercise books and white diagram expression scheme is</p>

		reasonable, the size and the technical requirements of the numerical query is correct, marking in line with the national standards, neat handwriting, drawing clean and tidy, basic concepts and related knowledge understanding is correct.
	75-89.	Able to grasp the related national standards, to master the correct standard parts drawing, master the engineering drawing dimensioning and technical requirements (limit, cooperate, geometric tolerance and surface structure, etc.) of the relevant basic knowledge and labeling method, query to various kinds of national standard method, can more clearly and concisely express complex parts and assembly, And can carry out commonly used national standards in the drawing process. Hand-painted exercise books and white drawing expression scheme are basically correct, individual size and technical requirements of the numerical query or labeling do not meet the national standards, handwriting is neat, drawing surface is clean and tidy, basic concepts and related knowledge understanding has a few mistakes.
	60-75.	Able to grasp the related national standards, basic grasp the correct standard parts drawing, engineering drawing dimensioning and technical requirements (limit, cooperate, geometric tolerance and surface structure, etc.) of the relevant basic knowledge and labeling method, various kinds of query method of national standard, reasonable to express complex parts and assembly, more do not conform to the national standard. There are many errors in hand-painted exercise books and white drawing expression schemes, and there are many errors in size and numerical query of various technical requirements. The handwriting is sloppy, the drawing is messy, and the erasure marks are obvious. There are certain errors in basic concepts and related knowledge understanding.
	0-59	Master some relevant national standards, the correct drawing method of a small number of standard parts, the basic knowledge and marking method

		<p>of engineering drawing dimension marking and various technical requirements (limit, fit, geometric tolerance and surface structure, etc.), master the query method of common national standards, unable to reasonably express more complex parts and assemblies.</p> <p>There are a lot of errors in hand-painted exercise books and white drawings, such as illegible handwriting, messy drawings, obvious erasure marks, and a lot of errors in basic concepts and related knowledge understanding.</p>
teaching Goal 2	Be able to draw and print complex part drawings and assembly drawings using a common tool.	
Evaluation of points mark quasi	90-100.	Able to create complex assembly, reasonable relationship, in line with the use of custom. Able to draw complex parts and assembly, reasonable layout, appropriate proportion, concise and clear expression scheme, all kinds of labeling in line with national standards. The document properties are set properly.
	75-89.	Able to create complex assembly, reasonable relationship, in line with the use of custom. It can draw complex parts and assemblies with reasonable layout, appropriate proportion, concise and clear expression scheme, and all kinds of marking basically meet the requirements of national standards. Most of the document attributes are set correctly and reasonably, in line with national standards, but some are wrong.
	60-75.	Can carry out the creation of more complex assembly, fit the relationship is basically reasonable, basically in line with the use of habits. It can draw more complex parts and assemblies, and the selection of expression scheme is not reasonable, there are many drawing errors, and many document attribute Settings do not meet the national standards.
	0-59	Ability to create simple assemblies. It can directly export 2d maps from 3D models and cannot be edited or modified. The expression scheme is unreasonable and does not conform to the habit

		of reading pictures and national standards.
Teaching Objective 3		Develop the ability to analyze problems independently and rigorous working attitude. Cultivate students' ability to analyze problems independently, solve problems and work cooperatively, cultivate serious and responsible working attitude and rigorous and meticulous working style, and enhance the awareness of engineering standardization.
Evaluation of points mark quasi	90-100.	Correct learning attitude, serious work, can correctly select and query national standards, drawing comply with national standards.
	75-89.	Correct learning attitude, serious homework, able to choose and query the national standard correctly, drawing basically comply with the national standard.
	60-75.	Correct learning attitude, the selection and query of national standards have certain mistakes, homework does not meet the national standards.
	0-59	Learning attitude is not correct, will not choose and query national standards, homework does not meet national standards.

7. The basis and method of course teaching objective achievement evaluation

1) Teachers' self-assessment

Teachers evaluate the achievement degree according to the supporting links of the course teaching objectives. See Table 5 for the evaluation table of the achievement degree of the course Teaching objectives in Engineering Drawing I (2) for specific methods. The target value of the achievement degree evaluation is 0.7, and the teaching objectives whose achievement degree is lower than 0.7 are not achieved.

2) Student questionnaire survey

After the completion of the course and submission of the results, the

Teaching Committee of the School of Mechanical and Material Engineering organized students to evaluate the teaching objectives of the course through a questionnaire survey (see Table 6), and conducted data statistics and analysis.

Table 6 Evaluation table of achieving teaching objectives of Engineering Drawing I (2) course

Course Number: 7033402 Semester: Class: Number of students: Teacher:

Course objective support link	Peacetime (70%)		Final examination score (30%)			course Total Score (100%)
	Hand job	Machine paint job	Course Objective 1	Course Objective 2	Course Objective 3	
Average student score						
The target score	30	40	25	0	5	100
Course objectives			Evaluation content	The target score	The average score	Achievement result
Teaching Objective 1. Further consolidate the basic knowledge of cartography. Learn and master basic knowledge of standard parts and common parts, part drawings and assembly drawings, and be able to read and draw drawings of complex parts and assemblies (more than 20 parts) by using drawing expression methods such as view and section view.			Hand job	30		$\frac{\sum \text{平时平均得分}}{\sum \text{平时目标分值}} \times 0.7 + \frac{\text{目标1平均得分}}{70} \times 0.3$
			Paper course Objective 1	25		
2. Be able to draw and print complex parts and assembly drawings using a common tool.			Machine paint job	40		$\frac{\sum \text{平时平均得分}}{\sum \text{平时目标分值}} \times 0.7$
Course teaching Objective 3. Develop the ability to analyze problems independently and rigorous working attitude. Cultivate students' ability to analyze problems independently, solve problems and work cooperatively, cultivate serious and responsible working attitude and rigorous and meticulous working style, and enhance the			Daily total work	70		$\frac{\sum \text{平时平均得分}}{\sum \text{平时目标分值}} \times 0.7 + \frac{\text{目标3平均得分}}{30} \times 0.3$
			Paper course Objective 3	30		

awareness of engineering standardization.				
Overall achievement of course teaching objectives		100		Total average score /100
Analysis of the common problems and causes in this assessment	<p>1. The question is:</p> <p>2. Cause analysis:</p>			
Continuous improvement advice				

Table 7 Questionnaire on achievement of teaching objectives of Engineering Drawing I (1) course

The serial number	Teaching Objectives of the course	Through the study of this course, I have achieved the teaching objectives of the course				
		Totally agree with	agree	Basic agree	Don't agree with	Totally disagree
1	Teaching Objective 1. Further consolidate the basic knowledge of cartography. Learn and master basic knowledge of standard parts and common parts, part drawings and assembly drawings, and be able to read and draw drawings of complex parts and assemblies (more than 20 parts) by using drawing expression methods such as view and section view.					
2	2. Be able to draw and print complex parts and assembly drawings using a common tool.					

3	Course teaching Objective 3. Develop the ability to analyze problems independently and rigorous working attitude.Cultivate students' ability to analyze problems independently, solve problems and work cooperatively, cultivate serious and responsible working attitude and rigorous and meticulous working style, and enhance the awareness of engineering standardization.					
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8. Evaluation basis and method of achievement degree of graduation requirement index points

The evaluation basis for the achievement degree of graduation requirement index points supported by this course is as follows: 1) Course teaching objectives supporting graduation requirement index points (Table 1) and achievement path (Table 2);2) Evaluation results of achievement of teaching objectives (Table 6).The evaluation method of achievement degree of graduation requirement index points is shown in Table 8. The weight of multiple teaching objectives supporting the same index point is determined according to the support degree of each teaching objective to the index point and by referring to the score value of each target in the final exam paper.

Table 8 Evaluation table of achievement degree of graduation requirements index points

Index point	The teaching goal	Goal achievement degree D_i	Weights of ω_i	Evaluation method of index point achievement degree
1.2	Teaching Objective 1		0.8	评价值=目标值 $\times\sum d_i\times\omega_i$
	Teaching Objective 3		0.2	
5.3	Teaching Objective 2		0.8	评价值=目标值 $\times\sum d_i\times\omega_i$

	Teaching Objective 3		0.2	
8.3	Teaching Objective 3		1.0	评价值=目标值 $\times\sum d_i\times\omega_i$

9. The connection and division of labor between this course and other related courses

Prerequisite: Engineering Drawing I (1).

Follow-up courses: Drawing practice, mechanical principle, mechanical design, foundation of interchangeability measurement technology, graduation project, etc.

10. Description of other types of problems

The teacher can make appropriate adjustments to the content and class hours according to the students' grasp of the situation.

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《工程制图 I (2)》

课程实验教学大纲

一、 课程基本信息

课程类型	<input type="checkbox"/> 独立设置的实验课 <input checked="" type="checkbox"/> 课内实验						
课程编码	7033402	学分	2	总学时	32	实验学时	8
课程名称	工程制图 I (2)						
课程英文名称	Engineering Drawing I (2)						
适用专业	机械设计制造及其自动化						
先修课程	7033401 《工程制图 I (1)》						
开课部门	机械与材料工程学院机械系						

二、 实验的性质与任务

《工程制图I (2)》的课程实验是机械设计制造及其自动化专业必修的一门专业基础实验课程。通过本实验的学习，使学生熟练掌握手工绘制零件图和装配图的方法和技能。

三、 实验教学内容与学时分配

序号	实验名称	学时	实验类型
1	零件图绘制	4	设计性实验
2	装配图绘制	4	设计性实验

四、 实验安排与要求

实验一：绘制零件图

根据给定零件，选择合理表达方案，手工绘制一组视图对零件结构信息进行完整表达，并进行尺寸及技术要求的标注和标题栏的填写。

实验二：绘制装配图

根据给定的装配体，选择合理表达方案，手工绘制一组视图对装配体结构信息进行完整表达，并进行尺寸及技术要求的标注和标题栏、明细表的填写。

五、 实验教学与其它相关课程的联系与分工

本实验先修课程为《工程制图I（1）》。为后续课程《机械原理》、《机械设计》等课程中工程图的识读和绘制打下基础。

六、 实验教学设计与教学组织

本实验教学采用随堂绘制，老师在绘图教室巡查，随时解答学生疑问，指导学生绘图的方式进行，以便及时发现和解决问题，便于学生更好地掌握技能要点。指导过程中穿插讲解国内先进绘图仪器及绘图方法的使用，提高学生的民族自信心和自豪感。

七、 实验教材、实验指导书及教学参考资料

实验教材

《机械制图》（第7版），大连理工大学工程图学教研室 编，高等教育出版社，2013年，9787040374872

《机械制图习题集》（第6版）大连理工大学工程图学教研室 编，高等教育出版社，2013年，9787040374889

2. 参考资料

《机械制图》（第7版），何铭新 钱可强主编，高等教育出版社，2016年，9787040441895

《机械制图习题集》（第7版），钱可强主编，高等教育出版社，2016年，9787040441505

八、 实验考核方法及成绩评定标准

实验成绩根据学生提交的作业进行判定。每个实验成绩以5分为满分。实验成绩计入平时成绩，占平时成绩的30%。

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