COLLEGE OF DESIGN UNIVERSITY OF MINNESOTA

HOUSEKEEPING Cover Sheet

Use this form for routine maintenance and housekeeping decisions.

[Revised July 2017]

Course DESIGNATOR and TITLE: PDES 3706 Designing for Manufacture

Career: ☐ Undergraduate ☐ Graduate

Unit: ☐ ARCH ☐ DHA ☐ HUMF ☐ LARCH ☐ MST ☐ INTERDISCIPLINARY

Program: Product Design

Submission from: A. DeVries / B. Kudrowitz

Submission date: December 27, 2017

Effective term (must be a future term): Fall 2018

Estimated student expense for taking this course: n/a

Required:

☐ **YES,** Academic Support Resources needed:
- ☐ Computer Lab
- ☐ Digifab Lab
- ☐ Goldstein
- ☐ Imaging Lab
- ☐ Libraries
- ☐ Other Technology
- ☐ Workshop

☐ **NO** Academic Support Resources need

Select change/s (Note: Course credit changes, cross-listing, inactivation, and/or significant content changes require the COURSE CHANGE Cover Sheet):

- ☐ Change in delivery format
- ☐ Change in grading method
- ☐ Change in prerequisite
- ☐ Change in term offered
- ☐ Other _____
- ☐ Change in catalog description
- ☐ Change in course number
- ☐ Change in course title
- ☐ Correction of typographical or grammatical errors

Program effect

Does this course change also change the program (including adding it as an elective)? ☐ YES ☐ NO

If yes, is Program Change form included this curricular review cycle or future cycle? ☐ YES, included ☐ NO, deferred

Related course changes under curricular review this cycle

Is this change related to other course changes under curricular review this cycle? ☐ YES ☐ NO

If yes, identify which other courses: _____

Briefly describe proposed changes (Executive Summary field in Workflow Gen)

Describe the planning and development activities that generated this course proposal. Include the following information: why the course is needed, which students are impacted, etc.

The class will be moved to Spring Semester so students can apply the content from this class to Studio 2. There will be lecture and lab component in the future.

Update Catalog Description:
This class is a hands-on overview to a variety of common manufacturing methods, tools, and considerations for product designers. The focus is placed on plastic and metal related processes specifically machining, forming, casting, and molding. Throughout the course, students apply the theory of design for manufacturing (DFM) and design for assembly (DFA) to a series of design projects. This course also covers related topics such as material identification, bill of material, cost estimation, part drawings, tolerances, fasteners, part finishing, and sourcing parts.

Electronic Course Authorization System (ECAS)

PDES 3706 - VIEW COURSE PROPOSAL

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Approvals Received:	**Department** on 1/26/18 by Amber Devries (devri126@umn.edu)
Approvals Pending:	**College/Dean** > Provost > Catalog
Effective Status:	Active
Effective Term:	**New:** 1189 - Fall 2018 **Old:** 1173 - Spring 2017
Course:	PDES 3706
Institution:	UMNTC - Twin Cities/Rochester
Campus:	UMNTC - Twin Cities
Career:	UGRD
College:	TALA - College of Design
Department:	12114 - DHA Product Design

General

Course Title Short:	Designing for Manufacture
Course Title Long:	Designing for Manufacture
Max-Min Credits for Course:	4.0 to 4.0 credit(s)
Catalog Description:	**New:** This class is a hands-on overview of common manufacturing methods, tools, and considerations for product designers. The focus is placed on plastic and metal related processes specifically machining, forming, casting, and molding. Throughout the course students apply the theory of design for manufacturing (DFM) and design for assembly (DFA) to a series of design projects. This course also covers related topics such as material identification, bill of material, cost estimation, part drawings, tolerances, fasteners, part finishing, and sourcing parts. **Old:** Hands-on exposure to a number of common manufacturing methods and the considerations in product design. Students will be able to apply the theory of design for manufacturing (DFM) and design for assembly (DFA) to other methods that may not be taught in this course. pre-req:PDES 3704, Product Design major or Product Design minor
Print in Catalog?:	Yes
CCE Catalog Description:	false
Grading Basis:	A-F
Topics Course:	No

Honors Course:	No
Online Course:	No
Freshman Seminar:	No
Is any portion of this course taught outside of the United States?:	No
Community Engaged Learning (CEL):	None
Instructor Contact Hours:	6.0 hours per week
Course Typically Offered:	**New:** Every Spring **Old:** Every Fall
Component 1:	LEC
Component 2:	**New:** LAB **Old:** <No text provided>
Auto Enroll Course:	**New:** Yes **Old:** No
Graded Component:	**New:** LAB **Old:** LEC
Academic Progress Units:	4.0 credit(s) (Not allowed to bypass limits.)
Financial Aid Progress Units:	4.0 credit(s) (Not allowed to bypass limits.)
Repetition of Course:	Repetition not allowed.
Course Prerequisites for Catalog:	<No Text Provided>
Course Equivalency:	<No text provided>
Cross-listings:	No cross-listings
Add Consent Requirement:	No required consent
Drop Consent Requirement:	No required consent
Enforced Prerequisites: (course-based or non-course-based):	009802 - PDES 3704, Product Design major or Product Design minor
Editor Comments:	3/26/2015: Approved by CCC (KAR) 10/27/15: Changing catalog description and adding prereqs. LWG 4/21/16: Adding pre product design as a prereq. LWG 10/26/16: Adding PDes 3704 and removing design minor as prereqs. LWG
Proposal Changes:	**New:** Updating catalog description and changing term offered. Adding lab component. **Old:** <No text provided>
History Information:	<No text provided>
Faculty Sponsor Name:	Barry Kudrowitz
Faculty Sponsor E-mail Address:	barryk@umn.edu

Student Learning Outcomes

Student Learning Outcomes

* Students in this course:

- Can communicate effectively

How will you assess the students' learning related to this outcome? Give brief examples of how class work related to the outcome will be evaluated.

â¿¢ Gain a firm understanding of the most commonly used manufacturing methods â¿¢ Be able to create engineering drawings that can be quoted by machine shops â¿¢ Understand the limitations and trade-offs of various manufacturing methods â¿¢ Know how to cost-reduce designs by selecting the most appropriate method, and â¿¢ Know how to design within the limitations of those methods

Please explain briefly how this outcome will be addressed in the course. Give brief examples of class work related to the outcome.

Assessment via Product Dissection, Product Assembly, Machining, 3D Printing + Casting, Injection Molded Component, Final Project, Final Exam

Liberal Education

Requirement this course fulfills: <no text provided>

Other requirement this course fulfills: <no text provided>

Criteria for Core Courses:

Describe how the course meets the specific bullet points for the proposed core requirement. Give concrete and detailed examples for the course syllabus, detailed outline, laboratory material, student projects, or other instructional materials or method.

Core courses must meet the following requirements:

- **They explicitly help students understand what liberal education is, how the content and the substance of this course enhance a liberal education, and what this means for them as students and as citizens.**
- **They employ teaching and learning strategies that engage students with doing the work of the field, not just reading about it.**
- **They include small group experiences (such as discussion sections or labs) and use writing as appropriate to the discipline to help students learn and reflect on their learning.**
- **They do not (except in rare and clearly justified cases) have prerequisites beyond the University's entrance requirements.**
- **They are offered on a regular schedule.**
- **They are taught by regular faculty or under exceptional circumstances by instructors on continuing appointments. Departments proposing instructors other than regular faculty must provide documentation of how such instructors will be trained and supervised to ensure consistency and continuity in courses.**

Criteria for Theme Courses:

Describe how the course meets the specific bullet points for the proposed theme requirement. Give concrete and detailed examples for the course syllabus,

detailed outline, laboratory material, student projects, or other instructional materials or methods.

Theme courses have the common goal of cultivating in students a number of habits of mind:

- **thinking ethically about important challenges facing our society and world;**
- **reflecting on the shared sense of responsibility required to build and maintain community;**
- **connecting knowledge and practice;**
- **fostering a stronger sense of our roles as historical agents.**

LE Recertification-Reflection Statement (for LE courses being re-certified only): <No text provided>

Statement of Certification:

This course is certified for a Core (blank) as of
This course is certified for a Theme (blank) as of

Writing Intensive

Propose this course as Writing Intensive curriculum: No

Question 1 (see CWB Requirement 1):

How do writing assignments and writing instruction further the learning objectives of this course and how is writing integrated into the course? Also, describe where in the syllabus there are statements about the critical role writing plays in the course.

<No text provided>

Question 2 (see CWB Requirement 2):

What types of writing (e.g., research papers, problem sets, presentations, technical documents, lab reports, essays, journaling etc.) will be assigned? Explain how these assignments meet the requirement that writing be a significant part of the course work, including details about multi-authored assignments, if any. Include the required length for each writing assignment and demonstrate how the 2,500 minimum word count (or its equivalent) for finished writing will be met.

<No text provided>

Question 3 (see CWB Requirement 3):

How will students' final course grade depend on their writing performance? What percentage of the course grade will depend on the quality and level of the student's writing compared to the percentage of the grade that depends on the course content? Note that this information must also be on the syllabus.

<No text provided>

Question 4 (see CWB Requirement 4):

Indicate which assignment(s) students will be required to revise and resubmit after feedback from the instructor. Indicate who will be providing the feedback. Include an example of the assignment instructions you are likely to use for this assignment or assignments.

<No text provided>

Question 5 (see CWB Requirement 5):

What types of writing instruction will be experienced by

students? How much class time will be devoted to explicit writing instruction and at what points in the semester? What types of writing support and resources will be provided to students?

<No text provided>

Question 6 (see CWB Requirement 6):

If teaching assistants will participate in writing assessment and writing instruction, explain how will they be trained (e.g. in how to review, grade and respond to student writing) and how will they be supervised. If the course is taught in multiple sections with multiple faculty (e.g. a capstone directed studies course), explain how every faculty mentor will ensure that their students will receive a writing intensive experience.

<No text provided>

Statement of Certification: This course is certified for a Theme (blank) as of

Course Syllabus

Course Syllabus: Designing for Manufacture

Course Designator PDES Section Number 001
Course Number 3706/5706 Semester and Year Fall 2015

Class Meeting Days & Time Monday, Wednesday, 6:15-9:00pm
Classroom Rapson XX
Number of Credits 4
Final Exam Date & Time
(Also state if there is NO final) No Final

Instructorâ¿¿s Information
Name Andrew Carlson
Office Location
Office Phone
Email carl2353@umn.edu
Office Hours Before/After Class and by Appointment

Course Information and Instructorâ¿¿s Expectations

Description

One of the final steps in creating a marketable product is the manufacturing of the components. Throughout the design process, designers and engineers must fully understand a variety of processes in which parts can be produced and assembled. Selecting a manufacturing method and ensuring the parts are capable of production is a difficult but critical part of the product design process.

The purpose of this course is to provide hands-on exposure to a number of common manufacturing methods and the considerations in product design. This course will allow students to apply the theory of design for manufacturing (DFM) and design for assembly (DFA) to other methods that may not be taught in this course.

This course is taught through project based learning with hands-on experience in designing new products and sub-components. One day a week, the lecture will discuss many different varieties of manufacturing within a theme. The other day the students will focus specifically on one method in that theme in a hands-on learning environment. For each assignment, students will need to design, model, and draft a new component focusing on a specific manufacturing method. Assignments will be graded on the design feasibility, and most importantly, their overall design for manufacturing.

For students who have not taken PDES 3704/5704 Innovative Computer Modeling and Rendering, you must complete the specified online Solidworks tutorials before the 3rd week of class in addition to the given assignments for the first three weeks.

Student Learning Outcomes following course completion: (must identify at least one outcome and how it relates to this course how it will be addressed and how it will be assessed, http://www.slo.umn.edu/)

This course focuses heavily on one of the approved student learning outcomes:
Communicating effectively
â¿¢ Gain a firm understanding of the most commonly used manufacturing methods

â¿¢ Be able to create engineering drawings that can be quoted by machine shops
â¿¢ Understand the limitations and trade-offs of various manufacturing methods
â¿¢ Know how to cost-reduce designs by selecting the most appropriate method, and
â¿¢ Know how to design within the limitations of those methods

Release of Work Statement:

Students understand that enrollment in this course grants consent for their work to be selected for inclusion in college or departmental publications (online or in print). Your instructor may select to use your work to represent her/his skills as an instructor in a teaching portfolio (online or in print).

Attendance:

Class participation grades are based on both attendance and quality of in-class activity. Attendance is crucial as every lecture builds on the last. Tardiness will also count against the participation grade. Only in certain circumstances as described in the Policies section will an absence or tardy not affect the grade.

Workload:

Students are expected to spend 9-12 hours outside of class time working on assignments each week.
Final Project: Graduate Level. For the final project in the course, students will be expanding on a homework product or creating something new. All students are expected to understand and communicate the details of their design in a manner that would be capable of being produced. Graduate level students will be expected to use multiple manufacturing methods in their design and include more complex parts (e.g. not simply laser-cut, or 3D-printed). Graduate students will also need to contact real vendors to have their parts quoted in reasonable quantities along with vendor-specific pricing on a complete bill of materials, tooling estimates, assembly labor, packaging, etc. The goal is for students to be able to, as detailed as possible without investment, estimate the total cost of production.

Textbook and Readings:

Design for Manufacturability Handbook, Second Edition, James Bralla

Grading Structure:

Absences will result in a grade deduction. Excused absences, however, will not affect your grade (see policy section). Tardiness will affect your class participation grade.

10% - Product Dissection, Assignment 1
10% - Product Assembly, Assignment 2
10% - Machining, Assignment 3
10% - 3D Printing + Casting, Assignment 4
10% - Injection Molded Component, Assignment 5
20% - Final Project
20% - Exam
10% - Class Participation

Students registered in PDES 5705, the graduate section, will be expected to submit a written report in addition to their final team project that documents their process and includes a detailed plan, BOM, and cost estimates for manufacturing their final design.

This extra project is not required for undergraduate students.

http://policy.umn.edu/Policies/Education/Education/GRADINGTRANSCRIPTS.html

Accepting and Returning Assignments:

Most assignments are due two weeks after they are assigned in lecture. Feedback and grades will be returned the week after assignments are submitted.

Grading Late Work:

Late assignments will receive a letter grade deduction for every day late.

Policy for Missed Exams:

Missed exams will be made up on the studentâ¿¿s time.

Make Up Work for Legitimate Absences:

Students will have an extra week to complete assignments missed from legitimate absences.
http://www.policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html

Extra Credit Options:

None

Schedule and Assignments:

Week 1: Introduction to Design for Manufacture and Class Structure
(Assignment 1: Product Dissection and Part Identification â¿¿ choose a product from a select list, do a product teardown, identify the material, cost, and manufacturing process for each component, develop an assembly drawing for the product, suggest improvements)

Week 2: Engineering Drawings and Communication / Material Identification

Week 3: Assemblies / Fasteners / Joining / Welding / Soldering
(Assignment 2: Design for Assembly â¿¿ using off-the-shelf electronics and joining components found on McMaster-Carr (and formed sheet metal?) design a light or lamp that can be easily mass produced)

Week 4: Forming / Sheet metal / Bending / Forging / Rolling / Shearing / Stamping

Week 5: Machining / Drilling / Milling / Turning
(Assignment 3: Machining â¿¿ Design a one piece 2D metal bottle opener that can be mass produced and produce 10 identical parts)

Week 6: 2D Cutting / Waterjet / Laser Cutter / Plasma Cutting / CNC Router

Week 7: Additive Manufacturing / 3D Printing / SLA / SLS / FDM /LOM
(Assignment 4: 3D Printing + Casting â¿¿ Design a simple two part mold for 3D printing to be used in casting a silicone part)

Week 8: Casting and Mold Making / Die Casting / Lost Wax / Sand Casting

Week 9: Injection Molding / Compression Molding
(Assignment 5: Injection Molding â¿¿ Design a simple part for injection molding)

Week 10: Thin and Hollow Moldings / Thermoforming / Blow Molding / Rotomolding

Week 11: Ceramic Processes /Fabric Processes

Week 12: Electronic Fabrication Processes
(Assignment 6: Final Project â¿¿ TBD)

Week 13: Finishes / Powder Coating / Deburring

Week 14: Project Workday / Final Crit

Week 15: Presentations and Critique

University Policies

Personal Electronic Devices in Classroom:

PEDs are not permitted in lecture.
http://policy.umn.edu/Policies/Education/Education/CLASSROOMPED.html

Use of Class Notes and Materials:

It is not permitted to profit off of the lecture notes from this class. If you want to reference slides or notes, please give credit to the course instructor and the University of Minnesota.
http://policy.umn.edu/Policies/Education/Education/CLASSNOTESSTUDENTS.html

Scholastic Dishonesty and Student Conduct Code:
http://www1.umn.edu/regents/policies/academic/Student_Conduct_Code.pdf

Sexual Harassment:

http://www1.umn.edu/regents/policies/humanresources/SexHarassment.pdf

Statement on Climate of Inclusivity:
You are expected to be attentive during class, ask questions if you do not understand something, and to offer your opinion. You are also expected to listen respectfully to other students and to me when speaking. The University of Minnesota is committed to providing a safe climate for all students, faculty, and staff. All persons shall have equal access to its programs and facilities without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation. Racism, sexism, homophobia, classism, ageism and other forms of bigotry are inappropriate to express in this class. Reports of harassment are taken seriously, and there are individuals and offices available for help.
(or refer to http://www1.umn.edu/regents/policies/administrative/Equity_Diversity_EO_AA.pdf)

Academic Freedom and Responsibility:
http://www1.umn.edu/regents/policies/academic/Academic_Freedom.pdf

Availability of Disability and Mental Health Services:
The University of Minnesota is committed to providing all students equal access to learning opportunities. Disability Services (DS) is the campus office that works with students who have disabilities to provide and/or arrange reasonable accommodations.
â¿¢ Students who have, or think they may have, a disability (e.g. mental health, attentional, learning, vision, hearing, physical or systemic), are invited to contact DS to arrange a confidential discussion at 612- 626-1333 (V/TTY) or ds@umn.edu.
â¿¢ Students registered with DS, who have a letter requesting accommodations, are encouraged to contact the instructor early in the semester to discuss accommodations outlined in their letter.
As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce your ability to participate in daily activities. University of Minnesota services are available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus via www.mentalhealth.umn.edu or contact Counseling/Consulting Services at 612-624-3323.

Academic Services:

If you would like additional help, please contact one of the offices listed below.

Center for Writing 10 Nicholson Hall, Mpls
612-626-7579

Student Academic Success Service 340 Appleby Hall, Mpls
199 Coffey Hall, St. Paul 612-624-3323

Strategic Objectives & Consultation

Name of Department Chair Approver:

Elizabeth Bye, ebye@umn.edu

Strategic Objectives - Curricular Objectives:

How does adding this course improve the overall curricular objectives of the unit?

F2016 change adds a prerequisite of PDes major, minor or instructor permission, anticipating approval of PDes bachelor of Science.

This course is one in a sequence of courses core to Product Design. Manufacturing is one of the last steps in bringing the ideas to fruition.

Strategic Objectives - Core Curriculum:

Does the unit consider this course to be part of its core curriculum?

Yes, this is a core course.

Strategic Objectives - Consultation with Other Units:

Before submitting a new course proposal in ECAS, circulate the proposed syllabus to department chairs in relevant units

and copy affiliated associate dean(s). Consultation prevents course overlap and informs other departments of new course offerings. If you determine that consultation with units in external college(s) is unnecessary, include a description of the steps taken to reach that conclusion (e.g., catalog key word search, conversation with collegiate curriculum committee, knowledge of current curriculum in related units, etc.). Include documentation of all consultation here, to be referenced during CCC review. If email correspondence is too long to fit in the space provided, paraphrase it here and send the full transcript to the CCC staff person. Please also send a Word or PDF version of the proposed syllabus to the CCC staff person.

No further consultation after initial proposed course was approved.

Consultation has occurred with the following individuals: Will Durfee, Mechanical Engineering; Mac McKeen, Manufacturing Operations Management; Shuzhong Zhang, Industrial and Systems Engineering; and Chris Cramer, Associate Dean of College of Science & Engineering. None saw significant overlap.

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