Eastern Illinois University
New Course Proposal
AET 4763, Rapid Prototyping Technology

This format is to be used for all courses submitted to the Council on Academic Affairs and/or the Council on Graduate Studies.

Please check one: <u>X</u> New course   <u> </u> Revised course

PART I: CATALOG DESCRIPTION

1. **Course prefix and number,** *such as ART 1000*: AET 4763

2. **Title** (*may not exceed 30 characters, including spaces*): Rapid Prototyping Technology

3. **Long title, if any** (*may not exceed 100 characters, including spaces*):

4. **Class hours per week, lab hours per week, and credit [*e.g., (3-0-3)*]:** 2-2-3

5. **Term(s) to be offered:** <u> </u> Fall <u>X</u> Spring <u> </u> Summer <u>X</u> On demand

6. **Initial term of offering:** <u> </u> Fall <u>X</u> Spring <u> </u> Summer **Year:** <u> 2015 </u>

7. **Course description:**
Introduction to rapid prototyping (RP) processes and basic principles of rapid prototyping technology. This course will include a study of engineering design, product development processes, design for manufacturing, and reverse engineering technology.

8. **Registration restrictions:**
   a. **Equivalent Courses**
      - **Identify any equivalent courses** (e.g., cross-listed course, non-honors version of an honors course). No other course

      - Indicate whether coding should be added to Banner to restrict students from registering for the equivalent course(s) of this course. <u> </u> Yes <u>X</u> No

   b. **Prerequisite(s)**
      - **Identify the prerequisite(s),** including required test scores, courses, grades in courses, and technical skills. Indicate whether any prerequisite course(s) MAY be taken concurrently with the proposed/revised course.
      AET 2043 – Computer-Aided Engineering Drawing (or equivalent course)

      - Indicate whether coding should be added to Banner to prevent students from registering for this course if they haven't successfully completed the prerequisite course(s). <u>X</u> Yes <u> </u> No

      If yes, identify the minimum grade requirement and any equivalent courses for each prerequisite course: "C" grade

   c. **Who can waive the prerequisite(s)?**
      <u> </u> No one <u>X</u> Chair <u> </u> Instructor <u> </u> Advisor <u> </u> Other (Please specify)

   d. **Co-requisites** (course(s) which MUST be taken concurrently with this one):

   e. **Repeat status:** <u>X</u> Course may not be repeated.

___ Course may be repeated once with credit.

Please also specify the limit (if any) on hours which may be applied to a major or minor.

    f. **Degree, college, major(s), level, or class** to which registration in the course is restricted, if any: n/a

    g. **Degree, college, major(s), level, or class** to be excluded from the course, if any: n/a

9. **Special course attributes** [cultural diversity, general education (indicate component), honors, remedial, writing centered or writing intensive] n/a

10. **Grading methods** (check all that apply): _X_ Standard letter   ___ CR/NC   ___ Audit   ___ ABC/NC ("Standard letter"—i.e., ABCDF--is assumed to be the default grading method unless the course description indicates otherwise.)

    Please check any special grading provision that applies to this course:

       ___   The grade for this course will not count in a student's grade point average.

       ___   The credit for this course will not count in hours towards graduation.

    If the student already has credit for or is registered in an equivalent or mutually exclusive course, check any that apply:

       ___   The grade for this course will be removed from the student's grade point average if he/she already has credit for or is registered in _____ (insert course prefix and number).

       ___   Credit hours for this course will be removed from a student's hours towards graduation if he/she already has credit for or is registered in _____ (insert course prefix and number).

11. **Instructional delivery method:** (Check all that apply.)

        ___ lecture   ___ lab   _X_ lecture/lab combined   ___ independent study/research

        ___ internship   ___ performance   ___ practicum or clinical   ___ study abroad

        _X_ Internet   _X_ hybrid   ___ other (Please specify)

PART II: ASSURANCE OF STUDENT LEARNING
   1. **List the student learning objectives of this course:**

     Upon the completion of this course, student should be able to:
       1. Explain concepts and basic principles of rapid prototyping technology
       2. Compare "pro" and "con" of using different manufacturing processes for rapid prototyping
       3. Analyze processes and materials that might be suitable for selected applications
       4. Relate the impact of rapid prototyping technology to industry and other communities
       5. Assess current applications and future expansions of the technology
       6. Design and develop physical prototypes through lab activities and assignments
       7. Develop a project that involves using concepts of rapid prototyping for a particular product

a. **If this is a general education course, indicate which objectives are designed to help students achieve one or more of the following goals of general education and university-wide assessment:**
    - **EIU graduates will write and speak effectively.**
    - **EIU graduates will think critically.**
    - **EIU graduates will function as responsible citizens.**

b. **If this is a graduate-level course, indicate which objectives are designed to help students achieve established goals for learning at the graduate level:**
    - **Depth of content knowledge. 2, 3, 4, 5, 6**
    - **Effective critical thinking and problem solving. 2, 3, 5, 6, 7**
    - **Effective oral and written communication. 1, 2, 4, 5, 6, 7**
    - **Advanced scholarship through research or creative activity. 3, 4, 5, 6, 7**

Objective	Depth of Content Knowledge	Effective Critical Thinking and Problem Solving	Effective Oral and Written Communication	Advanced Scholarship through research or Creative Activity
1			X	
2	X	X	X	
3	X	X		X
4	X		X	X
5	X	X	X	X
6	X	X	X	X
7		X	X	X

2. **Identify the assignments/activities the instructor will use to determine how well students attained the learning objectives:**

   The students will be required to participate in in-class discussion and activities. Students' understanding of the topics will be assessed regularly. This course will require students to develop a class project that utilizes concept of rapid prototyping technology. Students' critical thinking, oral, and written communication skills will also be evaluated through the project proposal and class presentation.

Objective	Class Project/ Presentation (30%), (27%)*	Lab Assignments (30%), (27%)*	Midterm Exam (20%), (18%)*	Quizzes (10%), (9%)*	In-class Activities/ Discussion (10%), (9%)*	Graduate Student Only (10%)*
1	X	X	X	X	X	
2	X	X	X	X	X	
3	X	X	X	X	X	
4	X	X	X	X	X	
5	X	X	X	X	X	
6	X	X				
7	X					
8						X
9						X

   *Graduate student

3. **Explain how the instructor will determine students' grades for the course:**

Class Project/Presentation	30%
Lab Assignments	30%
Midterm Exam	20%
Quizzes	10%
In-class activities/discussion	10%

Grading scale: A = 90% or above; B = 80 – 89%; C = 70 – 79%; D = 60 – 69%; F = below 60%
The instructor will determine students' grades through measured participation in class activities and discussion, student project evaluation, presentation, and student peer review evaluation.

4. **For technology-delivered and other nontraditional-delivered courses/sections, address the following:**
   a. **Describe how the format/technology will be used to support and assess students' achievement of the specified learning objectives:** EIU's Learning Management System will be used for online and hybrid sections of the course in addition to traditional communication methods such as e-mail and phone calls.
   b. **Describe how the integrity of student work will be assured:** The exams will be completed through the Learning Management System. Responses for all laboratory assignments, quizzes, exams, and class project will be analyzed by the originality checking software (e.g., TURNITIN).
   c. **Describe provisions for and requirements of instructor-student and student-student interaction, including the kinds of technologies that will be used to support the interaction (e.g., e-mail, web-based discussions, computer conferences, etc.):** Online discussion, e-mail, and phone calls.

5. **For courses numbered 4750-4999, specify additional or more stringent requirements for students enrolling for graduate credit. These include:**
   a. **course objectives;** Graduate students will have the additional learning objectives:
      - Analyze other technologies that could be related to rapid prototyping
      - Develop methods that may improve process steps or effectiveness of rapid prototyping systems
   b. **projects that require application and analysis of the course content; and**
      Class projects and lab assignments.
   c. **separate methods of evaluation for undergraduate and graduate students.**
      Graduate students will be required to individually develop an additional graduate level paper on a research topic related to rapid prototyping or other related technologies. The paper will reflect how graduate students synthesize and evaluate current problems in rapid prototyping systems or construct new ideas to improve the systems or technologies. The additional research paper for graduate students will meet the graduate school requirements in terms of format, critical thinking, analysis, and rigor.

6. **If applicable, indicate whether this course is writing-active, writing-intensive, or writing-centered, and describe how the course satisfies the criteria for the type of writing course identified. (See Appendix *.)**

PART III: OUTLINE OF THE COURSE

Provide a week-by-week outline of the course's content. Specify units of time (e.g., for a 3-0-3 course, 45 fifty-minute class periods over 15 weeks) for each major topic in the outline. Provide clear and sufficient details about content and procedures so that possible questions of overlap with other courses can be addressed. For technology-delivered or other nontraditional-delivered courses/sections, explain how the course content "units" are sufficiently equivalent to the traditional on-campus semester hour units of time described above.

Week	Topics (2-2-3)	Face to face or Online (equivalent 50-minute units)	Lab Activities (equivalent 50-minute units)
1	Introduction to rapid prototyping	2 units	2 units
2	Introduction to engineering design and product development process	2 units	2 units
3	Design for manufacturing and assembly	2 units	2 units
4	Basic principles of rapid prototyping technology; commercial development	2 units	2 units
5	Introduction to additive manufacturing for rapid prototyping	2 units	2 units
6	Processes & materials: Photopolymerization processes, Powder bed fusion processes	2 units	2 units
7	Processes & materials: Extrusion-based systems, Printing processes	2 units	2 units
8	Processes & materials: Sheet lamination processes, Beam deposition processes	2 units	2 units
9	Processes & materials: Direct write technologies Applications of additive manufacturing	2 units	2 units
10	Introduction to subtractive manufacturing for rapid prototyping	2 units	2 units
11	Processes & materials: Machining processes	2 units	2 units
12	Applications of subtractive manufacturing (rapid manufacturing, rapid tooling)	2 units	2 units
13	Reverse engineering technology	2 units	2 units
14	Industrial perspective	2 units	2 units
15	Research and development	2 units	2 units

This course will be mainly focused on the concepts, principles, and applications of rapid prototyping technology. Students will learn about the development of rapid prototyping systems (e.g. processes, materials, limitation, and applications). Students will get hands-on experience implementing the technology in lab activities and assignments.

PART IV: PURPOSE AND NEED

1. **Explain the department's rationale for developing and proposing the course.**
   As manufacturers compete to develop and launch new products, rapid prototyping systems are extensively adopted as a method for reducing time to the market. Learning principles and applications of rapid prototyping will help students understand the necessity of this technology and be able to apply their knowledge to real-world problems. As the Applied Engineering and Technology program within the School of Technology expands and revises its curriculum, familiarity with rapid prototyping technology is essential and will help better prepare students for their future careers. This course is also intended to provide an avenue for joint work with industrial partners.
   a. **If this is a general education course, you also must indicate the segment of the general education program into which it will be placed, and describe how the course meets the requirements of that segment.** n/a
   b. **If the course or some sections of the course may be technology delivered, explain why.** n/a

2. **Justify the level of the course and any course prerequisites, co-requisites, or registration restrictions.**
   As rapid prototyping systems utilize three-dimensional Computer-Aided Design (CAD) models in order to rapidly fabricate physical prototypes, this course will require prior knowledge about computer-aided design. Students will also develop and use the CAD models for lab assignments.

3. **If the course is similar to an existing course or courses, justify its development and offering.**
   a. **If the contents substantially duplicate those of an existing course, the new proposal should be discussed with the appropriate chairpersons, deans, or curriculum committees and their responses noted in the proposal.** n/a
   b. **Cite course(s) to be deleted if the new course is approved. If no deletions are planned, note the exceptional need to be met or the curricular gap to be filled.** n/a

4. **Impact on Program(s):**
   a. **For undergraduate programs, specify whether this course will be required for a major or minor or used as an approved elective.** This course will be an elective course for the AET program.
   b. **For graduate programs, specify whether this course will be a core requirement for all candidates in a degree or certificate program or an approved elective.** This course will be available for students enrolling in the graduate program in the School of Technology.

   If the proposed course changes a major, minor, or certificate program in or outside of the department, you must submit a separate proposal requesting that change along with the course proposal. Provide a copy of the existing program in the current catalog with the requested changes noted.

PART V: IMPLEMENTATION

1. **Faculty member(s) to whom the course may be assigned:**
   Dr. Wutthigrai Boonsuk, or other qualified faculty as assigned by department chair. Sections taught in Learning Management System (LMS) or hybrid formats will be taught by faculty who have completed EIU-approved training that qualifies him/her to teach online.

   If this is a graduate course and the department does not currently offer a graduate program, it must document that it employs faculty qualified to teach graduate courses.

2. **Additional costs to students:** There will be $60 fee for consumable materials used with lab equipment such as 3D printer, 3D scanner and Computer Numerical Control (CNC) equipment.

   Include those for supplemental packets, hardware/software, or any other additional instructional, technical, or technological requirements. (Course fees must be approved by the President's Council.)

3. **Text and supplementary materials to be used (Include publication dates):**
   Chua, C.K., & Leong, K.F.(2014). 3d Printing and Additive Manufacturing: Principles and Applications. Hackensack, NJ: World Scientific Publishing.

PART VI: COMMUNITY COLLEGE TRANSFER

If the proposed course is a 1000- or 2000-level course, state either, "A community college course may be judged equivalent to this course" OR "A community college course will not be judged equivalent to this course." A community college course will not be judged equivalent to a 3000- or 4000-level course but may be accepted as a substitute; however, upper-division credit will not be awarded.

PART VII: APPROVALS

Date approved by the department or school: 2/28/14

Date approved by the college curriculum committee: 4/28/14

Date approved by the Honors Council *(if this is an honors course):*

Date approved by CAA: 5/1/14   CGS:

*In **writing-active courses**, frequent, brief writing activities and assignments are required. Such activities -- some of which are to be graded – might include five-minute in-class writing assignments, journal keeping, lab reports, essay examinations, short papers, longer papers, or a variety of other writing-to-learn activities of the instructor's invention. Writing assignments and activities in writing-active courses are designed primarily to assist students in mastering course content, secondarily to strengthen students' writing skills. In **writing-intensive courses**, several writing assignments and writing activities are required. These assignments and activities, which are to be spread over the course of the semester, serve the dual purpose of strengthening writing skills and deepening understanding of course content. At least one writing assignment is to be revised by the student after it has been read and commented on by the instructor. In writing-intensive courses, students' writing should constitute no less than 35% of the final course grade. In **writing-centered courses** (English 1001G, English 1002G, and their honors equivalents), students learn the principles and the process of writing in all of its stages, from inception to completion. The quality of students' writing is the principal determinant of the course grade. The minimum writing requirement is 20 pages (5,000 words).

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