Course Objectives: This course introduces the student to the product design and development process. Tools, techniques and methods for product design and development are discussed in the class. Tools and techniques presented and discussed include teamwork (team dynamics, team norms and team tools), product development processes in organizations, customer needs and requirements analyses, setting product specifications, product concept generation methods, product concept selection methods, patents and intellectual property, product architecture design methods, design for usability, design for maintainability, design for assembly and disassembly, design for environment and product costing. The course includes a team based project in which student teams will generate and select concept designs for a consumer product [or a service]. After taking this course, students are expected to be proficient in using product design tools and techniques.

Course Meetings: Class meets Tuesdays from **6 to 850 PM in a Hybrid Format. Some class meetings will be in person, and others will be online. The In-Class Meetings will be held in BUSN 304.** Every class session will include a lecture (or an initial review of recorded lectures), in-class activities illustrating the lectures, sharing of in-class work and discussion, and activities on the product design project work.

Instructor: Dr. Arunkumar Pennathur, IMSE Department, apennathur@utep.edu.

Office Hours: Tuesdays, 12 to 2 PM in Person or Virtually. Other times by appointment – please send an email for either an in-person meeting or a Teams meeting. Email is a fast, convenient way to contact me. I read my email usually twice a day when I am in town and respond within a day if I am in town on weekdays. If I am traveling or if it is the weekend, please expect a slight delay in my response to your email.

Course Materials: The recommended textbook for this course is *Product Design and Development (Seventh Edition) by Karl T. Ulrich (U Penn), Steven D. Eppinger (MIT) and Maria C. Yang (MIT).* The book can be bought (either paperback or e-book) or rented from Amazon at the following link; this is the cheapest price I have been able to find:

https://www.amazon.com/Product-Design-Development-Karl-Ulrich/dp/1260566439/ref=sr_1_1?crid=IUYGWEETEMAX&keywords=product+design+and+development&qid=1705350657&sprefix=%2Caps%2C136&sr=8-1&ufe=app_do%3Aamzn1.fos.006c50ae-5d4c-4777-9bc0-4513d670b6bc

You can also use the older editions of the book.

The other recommended book you can consult is Product Development: A Structural Approach to Consumer Product Development, Design, and Manufacturing by A. Mital, A. Desai, A. Subramanian, and A. Mital (Elsevier, 2008). This book can be purchased at Amazon.com. Some other references you can consult (especially if you want to work in the product design field in the future) are:

1. M. Crawford and A. Di Benedetto, New Product Management, McGraw Hill, New York, 2005.
2. M.A. Annacchino, New Product Development: From Initial Idea to Product Management, Elsevier, New York, 2003.
3. D.W. Whitney, Mechanical Assemblies, Oxford University Press, New York, 2004.
4. Y. Haik, Engineering Design Process, Thompson Books/Cole, Pacific Grove, CA, 2003.
5. D.G. Ulman, The Mechanical Design Process, McGraw Hill, New York, 2000.
6. Donald Norman, The Design of Everyday Things. Basic Books, 2013.

I will also supply notes in the form of slides and other material – these can be found in the Blackboard page for the course.

Course Topical Coverage:

- Teamwork
- Product development processes in organizations
- Customer Needs Identification
- Concept Specification
- Concept Generation
- Patents and IP
- Concept Selection
- Product Architecture
- Design for Usability
- Design for Maintainability
- Design for Environment
- Design for Assembly and Disassembly
- Product Costing (time permitting)

Course Evaluation and Assessment Components

The course includes work you must complete individually and work you must complete with your team outlined as follows:

INDIVIDUAL WORK

Quizzes: This course will have a series of online, open-book, open notes, quizzes you will need to take individually via Blackboard. The quizzes are intended to ensure you keep up with reading and internalizing the material. The quizzes will be multiple-choice and/or short-answer and will test concepts from your text. Please refer to each quiz for further instructions about the quizzes.

Individual assignments: These assignments are of three kinds in general: an extension and analyses of tools and techniques we discuss in class to application examples, one page reflections on assigned videos, a list of barriers to successful teaming, individual notes that you write and keep and work that you perform on your team project, and your individual participation in class during class activities in general.

TEAMWORK

Class Project: Class Project will carry 60% of the total grade in this course. Note that we will spend time in class for your project team activities every class period and is intended to help you work toward project goals. The projects are team-based. Please refer to the project activities document for a description of the assignment and requirements.

The goals of the project are to work with product design and engineering needs of 2 clients in the borderland community – the Paso del Norte (PDN) Children's Network Early Childhood Learning Center, and the El Paso Visually Impaired and Blind Experience (VIBE) organization.

You can read about these organizations in the following links:

PDN Children's Network: https://pdnchildrens.org
El Paso VIBE: https://theelpasovibe.org

Leaders from these 2 organizations will also be visiting our class and speaking with you about their needs and requirements. After follow-up visits to these organizations and further interactions, you will be able to identify and develop a set of customer needs which can then be translated into engineering specifications. Further project activities will include generating conceptual designs to fulfill the technical specifications, evaluating and selecting the best concept for the product/service, and generating virtual prototypes for your final design. The clients will provide you with access to their facilities and points-of-contact for developing your customer needs and for obtaining feedback for your concept designs. A final project report and a final client presentation are components parts of this team project.

Project Proposal (will count as a team assignment): The clients will be presenting their needs and requirements in class in early February (the 3rd class). After we have had a meeting with the clients, and approximately in the middle of February, a team proposal is due with a design brief on the general design problem you will be working on with the client, and identifying the overall needs your project team will be working around.

Project Activities and Outcomes: Each team will engage in class activity (during the second half of the class sessions and as needed) intended to generate project outcomes for important milestone intermediate outcomes for the project, the final project presentation, and the final project report. You can create hand sketches (in fact, hand sketches are encouraged for conceptual sketching at the concept generation stage of the project). Your team must use Creo, AutoCAD or some other CAD package to generate your final drawings for your concept after you have selected promising concepts for further development and prototyping.

Final Project documentation report: The narrative should contain, at a minimum, the following elements [this is a suggested outline; you may have your own variation of this outline]:

- Mission Statement and Customer Needs List
    - A mission statement and design brief
    - An organized customer needs list for your product;
    - Describe the team's process for getting organized for customer needs assessment, and for identifying customer needs, analyzing the needs, and refining the final set of needs used. Please follow the process outlined in the text for these outcomes.
- Target Technical Specifications of Product/QFD Matrix
    - Please follow the process outlined in the text for generating this outcome.
- Concept Sketches (each student in the team will generate at least 4 concepts)
    - Concept Sketches
    - Describe the steps and the process you followed for concept generation
    - Be sure to include patents, competitive benchmarks, and any other special considerations you used for generating your concepts.
    - Please follow the process outlined in the text for these outcomes.
- Concept Selection
    - Sketches of 2 or 3 concepts you believe are the most promising
    - Show the concept selection matrix you used to make these choices
    - Include a sketch of the other alternative concepts you considered
    - Describe the team's process in concept selection. Please follow the process outlined in the text for this outcome.
- Final concepts and drawings – use CAD software of your choice to create software prototypes for your designs.
- Product usability and maintainability considerations
- Environmental considerations for product
- Documentation of your team processes, team meetings, and team reflections.

- You should keep thorough design documentation for all team project activities. The documentation should clearly indicate progress in your team project work. All the raw data, the meeting calendars, planning, minutes, and all documentation and the products generated from the meetings must be on MS Teams for your team, so I can track teamwork and team progress.

For a more detailed breakdown of requirements for the project report, please consult the assignment guidelines for final project report.

Final project presentation: Final presentation should be about 30 to 45 minutes long. The following is a suggested format for the final presentation:

- Title page
- Outline of the presentation
- Mission Statement/Design Brief
- Overview of your development process
- Project plan
- Task list (Gantt or PERT charts are good to have)
- Customer Needs List
- Product Specifications/QFD Matrices
- Any benchmarking
- Target Specifications
- Concept Generation & Sketches of various concepts considered
- Concept Selection and a Visual Prototype
- Conclusions & Lessons Learned
- References (if any)

The final presentation should be of the quality you will make to convince a top management group or a venture capitalist to purchase the rights to your concept and fund the final prototype development, and product launch.

An electronic copy of the report and the presentation should be submitted to the instructor before the final presentation on Blackboard.

Team activity and generation of milestone outcomes: Every class session related to the project will have team-based activities for your project work. Teaming will occur via file sharing via MS Teams project spaces. During the team activity, each team is expected to organize and work on activities that will help your team make progress towards milestone outcomes (of course, you can always be early). Please do not be absent for a class team activity. You can continue working with the draft and refining it further outside of class time as well.

Please include specific meeting agendas in your MS Team documentation with team members present, items you discussed in your team, the outcome from the activity (what you generated from the meeting), and items for follow-up activities.

For your in-class project team activities, please note the following:

1) You are expected to sort out upload/technology/team problems in advance.
2) Discuss team/project issues with me in advance. While I expect you to hold each other accountable in your teams, please notify me in advance if you need my help.
3) For any resources specific to the project (instruments, tools, books etc.,) and guidance, please contact me in advance.

4) Please come prepared to the class team project activities.
5) Project slides/presentation needs to be professional – clear, readable and thoughtful presentations.
6) Technical details and ideas need to be of the highest standards, like what you would give a real client. Mediocre work is never acceptable and will need to be revised to higher standards.

Course grading

Project design notes (Individual):	3%
In class participation (Individual):	12%
Quizzes (Individual):	10%
HW Assignments (Individual):	15%
Project Milestone Outcomes (Team):	10%
Project Final Written Report:	30%
Project Final Presentation:	20%

Standard UTEP letter grading scheme will be used for the final course grade:

A:	90-100%
B:	80-89%
C:	70-79%
D:	60-69%
F	<60%

Policy on Academic Dishonesty: Any attempts of academic dishonesty in any aspect of the course will **not be tolerated** and will be dealt with according to applicable UTEP Policy.

Technology Requirements

A part of the course content may be delivered via the Internet through the Blackboard learning management system. Please ensure your UTEP e-mail account is working and that you have access to the Web and a stable web browser. When having technical difficulties, update your browser, clear your cache, or try switching to another browser.

You will need to have access to a computer/laptop, a webcam, and a microphone and internet connection to attend synchronous zoom sessions that may be organized throughout the semester. You will need to download or update software and check that your computer hardware and software are up-to-date and able to access all parts of the course.

If you do not have a word-processing software, you can download Word and other Microsoft Office programs (including Excel, PowerPoint, Outlook and more) for free via UTEP's Microsoft Office Portal. Click the following link for more information about Microsoft Office 365 and follow the instructions.

IMPORTANT: If you encounter technical difficulties beyond your scope of troubleshooting, please contact the UTEP Help Desk as they are trained specifically in assisting with technological needs of students. Please do not contact me for this type of assistance. The Help Desk is much better equipped than I am to assist you!

Netiquette

As we know, sometimes communication online can be challenging. It is possible to miscommunicate what we mean or to misunderstand what our classmates mean given the lack of body language and immediate feedback. Therefore, please keep these netiquette (network etiquette) guidelines in mind. Failure to observe them may result in disciplinary action.

- Always consider audience. This is a college-level course; therefore, all communication should reflect polite consideration of other's ideas.
- Respect and courtesy must be provided to classmates and to the instructor at all times. No harassment or inappropriate postings will be tolerated.
- When reacting to someone else's message, address the ideas, not the person. Post only what anyone would comfortably state in a face-to-face situation.
- Blackboard is not a public internet venue; all postings to it should be considered private and confidential. Whatever is posted on in these online spaces is intended for classmates and professor only. Please do not copy documents and paste them to a publicly accessible website, blog, or other space.

Attendance And Participation

Your participation in the learning activities of the course is important not only for your learning and success but also to create a community of learners. Participation is determined by completion of the following activities:

- Reading/Viewing all course materials to ensure understanding of assignment requirements
- Participating in engaging discussion with your peers on the class activities
- Participating in scheduled zoom sessions for speakers and presentations
- Asking questions of the speakers and engaging in conversations
- Participating and contributing to the project activities.

Because these activities are designed to contribute to your learning each week, they cannot be made up after their due date has passed.

Zoom Sessions

This class requires that you participate in some scheduled Zoom sessions. The purpose of these sessions are for you to listen to guest speakers throughout the semester (when needed), engage in discussions with the speakers, do presentations and engage in discussion and class activities with your peers. These sessions will be announced right after the 3rd class session (when we are scheduled to have our clients present their problems in class face-to-face).

The Zoom link will be posted in the announcements on Blackboard.

Students are expected to, at least occasionally, participate in these sessions with a webcam and microphone. Students should not record the sessions and post them to any sites outside of Blackboard.

If you are unable to attend a Zoom session, please let me know as soon as possible so that accommodations can be made when appropriate.

Make-Up Work

Make-up work will be given *only* in the case of a *documented* emergency. Note that make-up work may be in a different format than the original work, may require more intensive preparation, and may be graded with penalty points. It is therefore important to reach out to me—in advance if at all possible—and explain with proper documentation why you missed a given course requirement. Once a deadline has been established for make-up work, no further extensions or exceptions will be granted.

Alternative Means Of Submitting Work In Case Of Technical Issues

I strongly suggest that you submit your work with plenty of time to spare in the event that you have a technical issue with the course website, network, and/or your computer. I also suggest you save all your work (answers to discussion points and essays) in a separate Word document as a back-up. This way, you will have evidence that you completed the work and will not lose credit. If you are experiencing difficulties submitting your work through the course website, please contact the UTEP Help Desk. You can email me your back-up document as a last resort.

Incomplete Grade Policy

Incomplete grades may be requested only in exceptional circumstances after you have completed at least half of the course requirements. Talk to me immediately if you believe an incomplete is warranted. If granted, we will establish a contract of work to be completed with deadlines.

Accommodations Policy

The University is committed to providing reasonable accommodations and auxiliary services to students, staff, faculty, job applicants, applicants for admissions, and other beneficiaries of University programs, services and activities with documented disabilities in order to provide them with equal opportunities to participate in programs, services, and activities in compliance with sections 503 and 504 of the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act (ADA) of 1990 and the Americans with Disabilities Act Amendments Act (ADAAA) of 2008. Reasonable accommodations will be made unless it is determined that doing so would cause undue hardship on the University. Students requesting an accommodation based on a disability must register with the UTEP Center for Accommodations and Support Services (CASS). Contact the Center for Accommodations and Support Services at 915-747-5148, or email them at cass@utep.edu, or apply for accommodations online via the CASS portal.

Scholastic Integrity

Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from or providing information to another student, possessing unauthorized materials during a test, or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or knowingly represents the words or ideas of another as ones' own. Collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. All suspected violations of academic integrity at The University of Texas at El Paso must be reported to the Office of Student Conduct and Conflict Resolution (OSCCR) for possible disciplinary action. To learn more, please visit HOOP: Student Conduct and Discipline.

Class Recordings

The use of recordings will enable you to have access to class lectures, group discussions, and so on in the event you miss a synchronous or in-person class meeting due to illness or other extenuating circumstance. Our use of such technology is governed by the Federal Educational Rights and Privacy Act (FERPA) and UTEP's acceptable-use policy. A recording of class sessions will be kept and stored by UTEP, in accordance with FERPA and UTEP policies. Your instructor will not share the recordings of your class activities outside of course participants, which include your fellow students, teaching assistants, or graduate assistants, and any guest faculty or community-based learning partners with whom we may engage during a class session. **You may not share recordings outside of this course.**

Copyright Statement For Course Materials

All materials used in this course are protected by copyright law. The course materials are only for the use of students currently enrolled in this course and only for the purpose of this course. They may not be further disseminated.

Course Resources

UTEP provides a variety of student services and support:
Technology Resources

- Help Desk: Students experiencing technological challenges (email, Blackboard, software, etc.) can submit a ticket to the UTEP Helpdesk for assistance. Contact the Helpdesk via phone, email, chat, website, or in person if on campus.

Academic Resources

- UTEP Library: Access a wide range of resources including online, full-text access to thousands of journals and eBooks plus reference service and librarian assistance for enrolled students.
- University Writing Center (UWC): Submit papers here for assistance with writing style and formatting, ask a tutor for help and explore other writing resources.
- Math Tutoring Center (MaRCS): Ask a tutor for help and explore other available math resources.
- History Tutoring Center (HTC): Receive assistance with writing history papers, get help from a tutor and explore other history resources.
- RefWorks: A bibliographic citation tool; check out the RefWorks tutorial and Fact Sheet and Quick-Start Guide.