Department of Mechanical Engineering Technology

Course number/name:
MECH 3520: Rapid Prototyping

Credits/contact hours:
3 credits, 2 class hours, and 2 lab hours

Instructor/coordinator:
Masato Nakamura, Assistant Professor of Mechanical Engineering Technology

Text book/title/author/year

Specific course information
Catalog description:
Introduces students to development of a new product. Explains major processes for rapid prototyping of a sample product before production, including stereolithography, powder (three dimensional printing); Solid (laminated-object manufacturing). Proper method selection for the process of rapid modeling of a sample product before mass production.

Pre/Corequisites:
MECH 1201, IND 2304

Required/elective/selected elective:
Selected elective for Mechanical Engineering Technology (Industrial Design Concentration [General Concentration])

Course learning objectives:
1. Mastery of the knowledge in rapid of prototyping techniques
2. Ability to identify and select the appropriate prototyping technique for a given application.
3. Ability to use rapid tooling equipment to manufacture prototypes for a given application.
4. Develop skills necessary for the use of prototyping techniques and their use in the industry.

Course addresses ABET student outcomes: 3a, 3b, 3c, and 3i and PC-1

Brief list of topics to be covered:

- Introduction to rapid parts building, History of the Process. Design project of a sample part, using 3D software. Introduction to 3D printers.

- Subtractive and Additive Processes. Tooling and machines used in rapid parts making from the design to production. Computer-based drafting packages, Interpretation software, Manufacturing software, Computer-numerical-control machinery. Introduction to stereolithography. Building parts by layers.

- Fused-deposition modeling and stereolithography. Specialty of the deposition modeling. Modeling of special types of parts. Selection of different methods for modeling.

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Designing difficult shapes using 3D softwares. Loading a designed part into a 3D printer. Analyzing the design for manufacturability and mass production. Making changes to a design.

- Processes of selective laser sintering and Ballistic-particle manufacturing.

- SLS process, special parts used for this process (ABS, PVC, Polyester, Wax, Special metals). Ballistic-particles modeling and manufacturing. 3DP Three-dimensional printing. Ceramic casting shell. Special mold design for this process. Rapid tooling.

- Laminated-object manufacturing and solid ground curing. Design project of an automotive part. Analyze part for design and mass production. Specialty of both processes, selection of parts. Special software used for the most profitable design. Student assignment and search for special design software. Present a short paper on the subject.

- Laser-engineered net shaping and virtual prototyping. Use of CAD in laser-engineered net shaping. Controlled-metal buildup (CMB), and precision-metal deposition (PMD). Virtual prototyping and software form of prototyping. Specials of this method. Designing a selected automotive part. Setting up to build the part.

- Direct manufacturing and rapid tooling. Direct production of engineering metal, ceramic, and polymer components or parts by rapid prototyping. Production of tooling by rapid prototyping for use in manufacturing operations.