IENG 506 Computer Aided Process Planning

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Prerequisites: Consent

Course Objectives:
The objective of the course is to introduce students to the fundamentals of computer aided process planning and its role in the manufacturability evaluation of product designs through effective selection of processes and support parameters.

Expected Learning Outcomes:
1. Students will understand the fundamentals of developing process plans based on design information.
2. Students will be able to select manufacturing processes and parameters to enable process plan development.
3. Students will be able to use computer aided methodologies for process plan development.
4. Students will be able to appreciate the effect of design changes on the manufacturability of the product.

Course topics:
1. Types of computer aided process planning
2. Machining, casting, forming processes
3. Machining process parameter selection using geometric programming
4. Cutting tools, cutting fluids, and surface technology
5. Machining, casting, forming economics
6. Analysis using MPSEL expert system software for machining parameter selection
7. Analysis using MACH machining cost estimation software for machining cost estimation
8. Analysis using AFS casting software
9. Process planning for machining of products with complex geometry
10. Verification of process plans using PROMODEL simulation

Course content:
1. Fundamentals of the variant and generative process planning systems. Case studies with respect to the role of process planning within the domain of simultaneous engineering.
2. Use of MPSEL, an expert system for generative process planning and MACH, a machining cost spreadsheet to develop a detailed process plan for a product on which all geometric details are provided. The effect of changes in design parameters such as geometry and material on the effectiveness of the process plan is investigated.
3. Use of AFS casting simulation software to analyze and develop product design configurations that will be expected to minimize casting defects.
4. Modeling aspects for machining parameter optimization using geometric programming techniques. Development of a spreadsheet for generating the results using a differential calculus based optimization approach as well as a heuristic approach.
5. Fundamentals of tolerancing and the effects of poor tolerancing at the design stage on the overall product manufacturing costs. Statistical techniques are used in the project to analyze the effects of tolerance build up on product rejection on account of poor design tolerancing.

6. Enabling a process plan to be most effective by analyzing it using PROMODEL, a manufacturing simulation software. Modeling the process plan and develop a realistic manufacturing scenario to balance the workload and improve the utilization of the machinery.

7. The effect of complex geometry product design on CNC machinability.

8. The theoretical and practical aspects related to the selection of various machining parameters such as cutting tools, cutting fluids, and tool angles.


10. The importance and operational details of various non traditional machining processes such as ultrasonic machining, laser beam machining, electrical discharge machining, electron beam machining, plasma machining, abrasive jet machining, and electrochemical machining. The students learn process selection with respect to generating required product design attributes.

**Grading:**
- Exam I – 20%
- Exam II – 20%
- Projects – 20%
- Quizzes (can be given at any time unannounced) – 10%
- Term paper – 10%
- Final exam – 20%

**Text:** B. Gopalakrishnan, Product Design and Process Planning in Concurrent Engineering, ISPE, 1996. In addition other relevant handouts provided.

**Statement on Attendance:**
Student attendance is mandatory unless excused by the instructor. The basis for an excused absence will follow University and IENG policy. Students who are absent from class for any reason are responsible for all missed work. Students who miss a quiz or an exam will not be allowed to make it up, except in the case of a family or other legitimate emergency. Any exception will be allowed at the discretion of the instructor.

**Statement on Social Justice:**
West Virginia University is committed to social justice. I concur with that commitment. I expect to foster a nurturing learning environment that is based upon open communication, mutual respect, and non-discrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, you must make appropriate arrangements through Disability Services (293-6700). They will identify the nature of the accommodation your disability requires.