

## **IENG 506 Computer Aided Process Planning Fall 2014**

**Instructor:** Bhaskaran Gopalakrishnan, PhD, PE, CEM, CPEnMS, LEED Green Associate  
Professor  
**Email:** [bgopalak@mail.wvu.edu](mailto:bgopalak@mail.wvu.edu)  
**Office:** 325D MRB  
**Office Hours:** M – 5:30-6:30 PM  
**Phone:** 304 293 9434  
**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, with specific focus on machining processes.

### **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 analyze the effect of design changes on the manufacturability of the product.

### **Course topics:**

1. Manufacturing processes fundamentals
2. Material properties and manufacturability
3. Manufacturing process selection and economics
4. Types of computer aided process planning
5. Machining process parameter selection using geometric programming
6. Cutting tools, cutting fluids, and surface technology
7. Machining parameter selection using expert system rules
8. Analysis using GP\_MACH and VISUAL MACH machining cost estimation software for machining cost estimation
9. Analysis using SOLIDCAST casting software
10. Process planning for machining of products with complex geometry using CNC machining
11. Tolerances

### **Course content:**

1. Fundamentals of manufacturing processes and process selection.
2. Fundamentals of the variant and generative process planning systems.
3. Use of expert system rules for generative process planning and GP\_MACH and VISUAL MACH, machining cost spreadsheets 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.
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 tolerances 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. The effect of complex geometry product design on CNC machinability.
7. The theoretical and practical aspects related to the selection of various machining parameters such as cutting tools, cutting fluids, and tool angles.
8. 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 electro chemical machining. The students learn process selection with respect to generating required product design attributes.
9. Use of SOLIDCAST casting simulation software to analyze and develop product design configurations that will be expected to minimize casting defects.

**Grading:** Exam – October 13, 2014, 30%  
Homework, Projects, Assignments – 20%  
Tests (can be given during any class period) – 20%  
Final exam – 30%

**Text:** Information will be provided.

**Statement on Attendance:**

Student attendance is mandatory unless excused by the instructor. The basis for an excused absence will follow University and IMSE policy. Students who are absent from class for any reason are responsible for all missed work. Students absent for the scheduled exam MUST inform the instructor about the reason for their absence PRIOR to the exam. If approved by the instructor, the make-up examination will be “added on” to the final examination and it may differ in scope and level of difficulty when compared to the original exam. Students who miss a test will not be given a make-up test unless the reason for missing the test is approved by the instructor and the instructor had been informed PRIOR to the test.

**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.

**08/18/14**