MEC7115: Computer Aided Manufacturing

Hours per semester				Weighted Total Mark	Weighted Exam Mark	Weighted Continuous Assessment Mark	Credit Units
LH	PT	TH	CH	WTM	WEM	WCM	CU
45	00	00	45	100	60	40	3

Course Description

In the past decades, Computer Aided Design (CAD) was developed to streamline and make the drafting functions more efficient, flexible and easy to manage. Computer Aided Manufacturing (CAM) in turn has developed to eliminate bottlenecks between the design and manufacturing stage. Traditional clerical functions have been integrated into a comprehensive computer controlled systems, including the generation of bills of materials, controlling the machine tools, manufacturing process planning, and machine cell control. CAM results in lower production and product costs, and increased business profitability.

The Course Objectives

This course introduces the students to CAM, CAD/CAM software and machine tool hardware. The benefits of CAM such as automation reliability, reduced production costs, seamless design and production process integration, increased product design and manufacturing flexibility, rapid prototyping, production planning, production inventory management, and the ongoing CAM advances to fully automate the production are explored. CAM is expensive, with incompatibilities caused by a non-existent global standard; factors a student is made aware of.

Learning Outcomes

The students are expected to learn how to:

1) Generate G-code from CAD drawings
2) Generate production process layouts based on part family analyses
3) Use CAM software (CAD is a prerequisite)
4) Generate part manufacturing programs in CAM and control of CNC machines

Detailed Course Content

- NC Machine programming (EMC2) (6 hours)
- Components of a NC system, NC coordinate systems,
- NC path control systems, NC position types,
- NC motion control types, Precision in positioning,
- NC part programming techniques, Applications of numerical control

Computer integrated manufacturing (10 hours)

- Using CATIA for part design and functional analysis,
- Using CATIA for part programming
- Part design and part programme generation
- Product manufacturing simulation and machining analysis

Manufacturing planning and control systems (4 hours)

Group technology [2, 3] (8 hours)

- Design attributes, Part manufacturing attributes,
- Key features of group technology, applications,
- Part Families and part family formation,
- Part family coding, Selection of classification and coding systems,
- Benefits of group technology,

Cellular manufacturing [2, 4] (6 hours)

- Cell design, Evaluation of cell design decisions,
- Cell formation approaches, Rank order clustering algorithm,
- Similarity coefficient-based approaches, Single-linkage cluster analysis
- Exceptional parts and bottleneck machines, Cell design evaluation

Project (52 hours)

Course delivery and Learning Pattern

Lectures will be conducted to cover the course material. The course content will be presented in slide format, in sufficient detail to constitute class notes. The slides will be provided in advance of the lectures. Some material will be covered in class and students will be informed when expected to make notes. Demonstrations of the concepts covered in some lectures, simulations and programs will be used to reinforce the learning.

Course Assessment

Course assessment will be through 2 assignments, a test, 2 individual assignments, and examinations, which will constitute:

• Course work assignments 20%
• Test 20%
• Project Labs 60%

References

[1] Dessault Systemmes CATIA V5R17, (2006) “Computer aided tri-dimensional application -NC Machining”.

[2] Groover M.P,(2007) “Fundamentals of modern manufacturing: Materials, processes, and systems”, *John Wiley and Sons, Inc*, .

[3] Tien Chien Chang, Richard A. Wysk, and Hsu Pin Wang, (2008) “Computer-aided manufacturing”,
Pearson Education, ISBN 9788131721643.
[4] Programming with MATLAB, “MATLAB-The Language of Technical Computing”, *http://www.mathworks/products/matlab*.