Western University
Department of Mechanical & Materials Engineering

MME 4480b – Computer-Aided Design

COURSE OUTLINE – 2013-14

CALENDAR DESCRIPTION:

This course is an introduction to computer-aided design (CAD) technologies and their basic underlying mathematical principles. Topics include geometric modeling schemes, parametric representation of curves and surfaces, computer-aided design analysis, data exchange standards, rapid prototyping, and viewing and object transformations.

COURSE INFORMATION:

Instructor: Professor R. Tutunea-Fatan
Office: SEB 2063A; Phone 519-661-2111, ext. 88289
E-mail: rtutunea@eng.uwo.ca

Lectures: Mon. 10:30-12:30 (TEB 454)
Wed. 12:30-1:30 (TEB 454)

Labs: Section 002 Mon. 3:30-5:30 (SEB 1012)
Section 003 Thu. 9:30-11:30 (SEB 1004)

PREREQUISITES:

Engineering Science 1036a/b and successful completion of 3rd year of the Mechanical Engineering program or permission of the Department.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

ACCREDITATION UNITS:

Engineering Science = 70%, Engineering Design = 30%.

TOPICS:

1. Introduction to CAD systems
2. Basic modeling
3. Advanced modeling
4. Data exchange
5. Emerging trends in CAD

SPECIFIC OBJECTIVES:

At the end of each section you should be able to describe and/or understand:

Section 1:

- Definition of CAD
- Role of CAD in engineering design process
- CAD-related systems: PDM/PLM and CAD/CAM/CAE
- CAD/CAM/CAE integration
- Overview of CAD/CAM/CAE software market
- Components of CAD systems
- Technologies underlying computer graphics

Section 2:

- Types of CAD models
- Geometry and topology in CAD
- Solid and non-manifold models
- Boundary representation of solids (B-rep)
- Common CAD tools: coordinate systems, datums and reference geometry, sketches
- Communication of CAD models
- Design Intent
- Best modeling strategy
- Features and macros
- Examples of mechanical component modeling
- Assemblies: modeling strategies, mates, interference and collision detection, motion simulation

- Rendering: scenes, lighting, animation
- Drafting: types of drawings, drafting conventions, geometric dimensioning and tolerancing

Section 3:

- Curves: types of curves, parametric curves, polynomial representations, Bezier curves, B-Splines, NURBS
- Manipulation of curves in CAD
- Surfaces: parametric representations, planar surface, bilinear surface, bicubic patch, Bezier surface, B-Spline surface, NURBS surface
- Manipulation of surfaces in CAD

Section 4:

- CAD data flow in global manufacturing
- CAD interoperability
- Data exchange errors: sources, issues, elimination/workarounds
- Types of data exchange
- Common neutral formats: IGES and STEP

Section 5:

- Direct modeling
- Today's CAD modeling challenges

GENERAL LEARNING OBJECTIVES

Knowledge Base	X	Individual Work	X	Ethics and Equity	
Problem Analysis	X	Team Work		Economics and Project Management	X
Investigation	X	Communication	X	Life-Long Learning	X
Design	X	Professionalism	X		
Engineering Tools	X	Impact on Society	X		

CONTACT HOURS: 3 lecture hours, 2 laboratory hours, half course

SUGGESTED TEXTS: *Mastering CAD/CAM. 2005. Ibrahim Zeid. McGraw Hill.*
NX 8.5 for Designers. 2013. Sham Tickoo. CADCIM Technologies.
Mastering SolidWorks, the Design Approach. 2011. Ibrahim Zeid. Prentice Hall.

UNITS: Metric and Imperial

EVALUATION: The final grade in the course will be determined according to the following weighting scheme:

Assignments	11%
Computer workshops	9%
Projects	30%
Final Examination	50%

Please note that:

- Lab session attendance is **mandatory**.
- Only non-programmable calculators will be allowed during final examination (closed book).
- If a minimum of 50% is not obtained on the final examination, the student cannot receive a final mark greater than 48%.

Term coursework will be carried out according to the following **tentative** schedule:

Evaluation Method	Weight	Assigned	Deadline
Workshop 0	0	Jan. 6	Jan. 10
Workshop 1	1.5%	Jan. 13	Jan. 17
Workshop 2	1.5%	Jan. 20	Jan. 24
Workshop 3	1.5%	Jan. 27	Jan. 31
Assignment 1	3%	Jan. 27	Feb. 3
Workshop 4	1.5%	Feb. 3	Feb. 7
Project 1	15%	Feb. 3	Feb. 28
Workshop 5	1.5%	Mar. 3	Mar. 7
Workshop 6	1.5%	Mar. 10	Mar. 14
Assignment 2	3%	Mar. 10	Mar. 21
Project 2	15%	Mar. 10	Apr. 4
Assignment 3	5%	Mar. 24	Apr. 4

Term coursework topics:

- Workshop 0: Introduction to NX (on your own)
- Workshop 1: Feature modeling
- Workshop 2: Assembly modeling
- Workshop 3: Drafting
- Workshop 4: Visualization and rendering
- Workshop 5: Curves
- Workshop 6: Surfaces
- Assignment 1: Modeling comparison: SolidWorks vs. NX
- Assignment 2: Data exchange capabilities
- Assignment 3: Parametric representation of curves
- Project 1: Assembly modeling and motion simulation
- Project 2: Reverse engineering of complex surfaces

ENGLISH: In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests and examinations for improper use of English. Additionally, poorly written work, with the exception of final examinations, may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

CONSULTATION HOURS: To be announced.

CLASSROOM DEMEANOR: The instructor is committed to providing a respectful learning environment for all students involved in this course. This is a collective responsibility of the instructor and students, and therefore students partaking in this course agree to abide by this criterion. This includes arriving at lectures on time, and acting in a professional manner during class.

ATTENDANCE: Any student, who, in the opinion of the instructor, is absent too frequently from class or laboratory periods in any course, will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular examination in the course.

SSD: *Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.*

CHEATING: University policy states that cheating, including plagiarism, is a scholastic offense. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

NOTE: The above topics and outline are subject to adjustments and changes as needed. Students who have failed an Engineering course (ie.<50%) must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted for grading by the student in subsequent years.

January 2, 2014