CALENDAR DESCRIPTION
This course is an introduction to the use of modern computer-aided design (CAD) techniques in generation of 3D
digital models from physical objects. Topics include contact and non-contact data acquisition techniques, data type
and exchange formats, and advanced visualization and surfacing techniques.

COURSE INFORMATION
Instructor: Prof. Pawel Kurowski
e-mail: pkurows@uwo.ca
Lectures: M 2:30-3:30 ACEB2415, Th 1:30-2:30 ACEB1400, F 2:30-3:30 ACEB1400
Labs: Tu 2:30-4:30 ACEB2415
Consultations: by appointment

PREREQUISITES
MME 2259A/B or MSE 2202A/B

ACCREDITATION UNITS
Engineering Science 70%, Engineering Design = 30%

TOPICS
1. Introduction to reverse engineering of physical objects
   • historical notes on reverse engineering (RE)
   • overview of RE process
2. Data acquisition techniques
   • classification of RE techniques
   • noncontact techniques: laser scanning, CT/MRI
   • contact techniques: coordinate measurement machine (CMM)
   • destructive techniques
   • case studies involving RE
3. Data types and data exchange formats
   • nonparametric data formats: cloud of points, polygonal mesh
   • parametric data format (B-Rep/NURBS)
   • polygonal vs. parametric data
   • data exchange operations
   • mitigation of data exchange errors
4. Parametric data reconstruction
   • nonparametric to parametric data conversion
   • computer graphics and graphical output of CAD
   • modeling strategies: history-based and direct
   • manifold and non-manifold models
   • surfacing operations and functionality
   • surface quality analysis; class A surfaces
   • industrial applications of class A surface
   • accuracy of parametric data reconstruction
5. Additive manufacturing
   • review of additive manufacturing technologies
   • materials
   • model preparation
   • printing scanned models
LEARNING OUTCOMES
Upon the successful completion of the course, students will:

• Understand the principles underlying data acquisition in the context of reverse engineering of physical objects.
• Compare and exploit the capabilities of different data acquisition techniques to generate digital models of physical objects.
• Understand the structural differences between the different types of CAD data formats.
• Select and use the appropriate format for a CAD data exchange operation.
• Understand the theoretical basis of internal CAD representations.
• Develop strategies and skills for manipulation and modeling for freeform/complex/sculptured surfaces.
• Select and implement additive manufacturing processes to 3D scanned models

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

COURSE TEXTBOOKS
Raja V., Fernandes, K.J., Reverse Engineering, an Industrial Perspective, Springer-Verlag, 2008 (recommended)

EVALUATION
The course grade will be determined as follows:
Four assignments                              12%   Sep 26, Oct 17, Nov 14, Nov 28
CSWPA-SU test                                 12%   Nov 15
CSWA-AM test                                  6%    Dec 6
Mid-term examination                          20%   Oct 25
Final examination                             50%   During examination period

If deadlines for assignments are not met, two days grace period will be allowed with 5% penalty per day. Delay of more than two days will result in mark zero.

COMPUTER SOFTWARE
Student version of Solidworks 2022 program will be available on all lab computers and for installation on student’s computer.

COURSE POLICIES
If a student misses the midterm exam with consideration, the weight of the midterm exam will be applied to the final exam. If student misses the midterm exam without consideration, the midterm exam’s mark will be zero.

If technical issues prevent a student from successfully completing and submitting the midterm examination, at the instructor discretion the weight of the examination may be shifted to the final exam. No make-up midterm examination will be offered in this case.

If technical issues prevent a student from successfully completing and submitting the final examination, the official guidelines from Associate Dean’s Office, Undergraduate Affairs will be followed. Options to be considered will include, but without being limited to, oral examination or make-up examination in the special examination period.
If legitimate cause for suspicion of cheating during tests, midterm exam or final exam exists, the student will be required to participate in a one-on-one oral examination with the instructor. The mark obtained in the oral examination will supersede the one obtained during the written quiz. If the student refuses his/her participation in the oral examination, the examination will be automatically graded with zero and further academic penalties for scholastic offences will be applied.

Students are required to contact the instructor of the course for any other circumstances that appear to not be covered by the non-exhaustive list above.

**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, except for the 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.

**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**
Regular attendance is essential. 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.

**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.