SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE:	MECHANICS OF MACHINES I		
CODE NO. :	MCH204	**SEMESTER:**	FIVE
PROGRAM:	MECHANICAL TECHNOLOGY		
AUTHOR:	TOM KATAGIS/MARK SEELER		
DATE:	SEPT 2010	**PREVIOUS OUTLINE DATED:**	APRIL 2010
APPROVED:	*"Corey Meunier"* **CHAIR**		_____ **DATE**
TOTAL CREDITS:	FOUR		
PREREQUISITE(S):	MCH110 – APPLIED MECHANICS MTH146 – MATHEMATICS		
HOURS/WEEK:	FOUR		

I. COURSE DESCRIPTION:

The student will study mechanism, displacement diagrams of machine members by relative velocity method, instantaneous centers, and velocity polygon, relative acceleration polygon, coriolis acceleration, straight and curved links.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course, the student will demonstrate the ability to:

1. Introduction To Machine Mechanics.

Potential Elements of the Performance:

- Understand what a machine is and how it is important
- Define Terms that are pertinent to mechanics of machines
- Define a link (Element) and be able to identify link in a machine
- Identify kinematic pairs and understand what it means to have a kinematic pair within a machine
- Explain a kinematic chain and how it is important to machines
- Interpret the relationship for constrained motion in a mechanism in planar motion also known as Grubler's criterion
- Understand the impact of degrees of freedom for a given system and be able to calculate the degrees of freedom
- Explain Inversion of Mechanisms of a machine
- Identify the three mechanisms known as Grashof's type I and the mechanism known as Grashof's type II for a quadric cycle chain
- Be able to determine which mechanism is being illustrated
- Understand the mechanisms of single slider crank chain and be able to describe Whitworth quick return motion and crank and slotted lever quick return motion,
- Understand Dead centers and change points
- Understand other various Kinematic Chains

2. Kinematics of Rigid Bodies.

Potential Elements of the Performance:

- Understand simple vector operations such as dot product and cross product
- Explain dimensions of significance
- Compute velocity and acceleration of a Quadric Cycle Chain utilizing the relative velocity method and the acceleration

method
- Compute velocity and acceleration of a Single Cylinder Crank Chain utilizing the relative velocity method and the acceleration method
- Explain compound kinematic chains
- Utilize the instantaneous center method to compute velocity directly from the space diagram.
- Utilize the analytical method
- Demonstrate the ability to complete Fourier series expansion
- Using vector approach solve problems involving kinematics of links having space motion

3. Dynamics of Rigid Links.

Potential Elements of the Performance:
- Utilize the method of joints and the method of sections to solve problems regarding dynamics of rigid links
- Understand Plane Motion with reference to single slider crank mechanisms
- Understand Plane Motion with reference to quadric cycle chain mechanisms
- Interpret Dynamic Plane motion and solve appropriate problems associated
- Complete inertia force analysis
- Explain and understand Three Dimensional Dynamic Analysis and mass moments of inertia

4. Cam Dynamics.

Potential Elements of the Performance:
- Define cam dynamics
- Determine the cam linkage required and the proper shape of the cam to bring down the acceleration of the linkage to acceptable limits
- Interpret the Cam profile for a known follower response
- Explain the response of a parabolic cam response
- Explain the response of a simple harmonic cam
- Explain the response of a cycloidal cam
- Explain the response of a polynomial cam
- Identify the characteristic equations of various types of cams
- Compare the characteristics of various types of cams
- Utilizing the graphical approach indicate the cam profile for a given lift or fall
- Draw the cam profile for roller follower with the line of stroke passing through the axis of the cam shaft, flat foot follower.

Roller follower with an offset and roller follower with a rocker arm
- Explain the analytical approach for a pitch curve for various types of cams
- Understand cams with straight lines and circular arcs
- Explain eccentric cams

5. Theory of Gears.

Potential Elements of the Performance:
- Explain what is achieved through the use of gears
- Identify various types of gears and orientation
- Define velocity ratio
- Define pitch point
- Interpret motion transmitted by two surfaces in contact
- Understand the continuity of contact between two surfaces
- Explain pure rolling and constant velocity ratio
- Describe and understand conjugate action
- Define pitch circles, circular pitch, diametrical pitch, module, addendum circle, dedendum circle, dedendum, addendum, height of tooth, clearance, path of contact, arc of contact, arc of approach, arc of recess, pinion, gear
- Understand profiles satisfying constant velocity ratio condition
- Discuss the minimum number of teeth of involute gears
- Define the term interference
- Solve for and explain the contact ratio
- Understand the comparison between involute and cycloidal gears
- Identify and discuss the methods of reducing or eliminating interference
- Understand and explain the function of helical gears
- Understand and explain the function of worm gearing
- Estimate the efficiency of various types of gears from elementary principles
- Explain the processes by which teeth on a gear are manufactured

III. TOPICS:

1. Introduction to Machine Mechanics
2. Kinematics of Rigid Bodies
3. Dynamics of Rigid Links
4. Cam Dynamics
5. Theory of Gears

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Ramamurti, V, Mechanics of Machines 2nd Edition, Alpha Science International Ltd, ISBN 1-84265-220-6

V. EVALUATION PROCESS/GRADING SYSTEM:

Type of Grading	Duration	Mark Breakdown	Topics
Mid Term	**2.0 hours**	**30%**	**Review of chapters 1,2 and 3 – Introduction to Machine Mechanics, Kinematics of Rigid Bodies and Dynamics of Rigid Links**
Final Exam	**2.0 hours**	**45%**	**Review of all course Material with emphasis on Cam Dynamics and Gear Theory**
In Class Quizzes		**25%**	**All Course Material – 1 Quiz per chapter**

The following semester grades will be assigned to students:

Grade	Definition	*Grade Point Equivalent*
A+	90 – 100%	4.00
A	80 – 89%	
B	70 - 79%	3.00
C	60 - 69%	2.00
D	50 – 59%	1.00
F (Fail)	49% and below	0.00

CR (Credit)	Credit for diploma requirements has been awarded.
S	Satisfactory achievement in field /clinical placement or non-graded subject area.
U	Unsatisfactory achievement in field/clinical placement or non-graded subject area.
X	A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.
NR	Grade not reported to Registrar's office.
W	Student has withdrawn from the course without academic penalty.

VI. SPECIAL NOTES:

Attendance:
Sault College is committed to student success. There is a direct correlation between academic performance and class attendance; therefore, for the benefit of all its constituents, all students are encouraged to attend all of their scheduled learning and evaluation sessions. This implies arriving on time and remaining for the duration of the scheduled session.

VII. COURSE OUTLINE ADDENDUM:

The provisions contained in the addendum located on the portal form part of this course outline.