**MENG 253 – Dynamics and Mechanisms - Course Outline**

**Course:** MENG 253– Dynamics and Mechanisms, 2019
**Instructor:** Ghasem Sam Behfarshad
**Office:** TEC 264
**Email:** behfarshadg@camosun.bc.ca

## Calendar Description

Students will study the kinematics and dynamics of particles and rigid body in two and three dimensions. The kinematics and dynamics analysis will be used for mechanisms to determine the position, velocity, acceleration, and forces acting on each component. Analyzed mechanisms include four-bar-links, piston-sliders, cams and gear trains.

Only open to students in the Mechanical Engineering Technology program.

## Intended Learning Outcomes

Upon successful completion of this course a student will be able to:

- Analyze mechanisms, graphically and analytically, to determine velocity, acceleration and force.
- Calculate the angular velocities of gears in simple, compound, and planetary gear trains.
- Select the mass and radius of flywheels to minimize the needed power output of the prime-mover in applications with varying power requirements or to smooth the varying output of a power source.
- Analyze one and two-degree of freedom, free and forced, damped and undamped, vibrating systems to determine natural frequencies and amplitude ratios:
    - using Coulomb, hysteresis, and viscous damping models
    - for steady-state and transient responses.
- Select vibration isolation and transmission devices to produce the desired transmission ratios.
- Calculate the balance of systems of reciprocating and rotating masses.

## Text & References

***No course textbook is required for MENG 253.***

# Course Outline (subject to modification, if necessary)

| | Week | Course Content |
|---|---|---|
| Dynamics | 1 | Vector analysis of dynamic systems, algebraic methods. |
| | 2 | Kinematics of a particle, position, velocity and acceleration analysis of particles and rigid bodies |
| | 3 | Curvilinear motion in different co-ordinates systems, absolute and relative motions of particles. |
| | 4 | Kinetics of a particle: Force and acceleration. |
| | 5 | Kinetics of a particle: Work and energy. |
| | 6 | Planar kinematics of a rigid body. |
| | 7 | Planar kinetics of a rigid body: Force and Acceleration |
| Mechanisms | 8 | Introduction to mechanisms, complex numbers, degrees of freedom, review of vectors, position analysis, velocity analysis. |
| | 9 | Relative velocities in mechanisms, relative sliding velocity, instantaneous centers of zero velocity. |
| | 10 | Linear and angular acceleration analysis in mechanisms, relative acceleration examples. |
| | 11 | Coriolis and sliding acceleration analysis. |
| | 12 | Static forces in machines, inertial forces in machines. |
| | 13 | Combined static and inertial force examples. |
| | 14 | Gears and gear trains, planetary gear trains, analysis of cams and cam design. |

## Assignments

Lab sessions may consist of simple experiments, tutorials and in-class exercises using AutoCAD, MS Excel, and MATLAB software, where required. **No late lab reports, exercises or assignments are accepted for grading.**

## Evaluation & Grading System

| | | |
|---|---|---|
| ***Assignments*** | 10% | |
| ***Lab Exercises*** | 10% | |
| ***Midterm Exam*** | 35% | (closed book/notes) |
| ***Final Exam*** | 45% | (closed book/notes) |

→ ***You must pass the final exam in order to pass MENG 253***

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|---|---|---|---|
| A+ | 90-100 | B- | 70-72 |
| A | 85-89 | C+ | 65-69 |
| A- | 80-84 | C | 60-64 |
| B+ | 77-80 | D | 50-59 |
| B | 73-76 | F | <50 |