

Camosun College
Mechanical Engineering Technology
MENG 254 - Machine Design
Course Outline

Calendar Description:

The students will apply failure theories for various types of materials exposed to static and repeated loading, so as to determine components lifetime. Design of machines using fasteners, shafts, bearings, belt-drives, spur gears, clutches, and brakes will be considered. Solving of design problems is assisted by computer methods. Specification and selection of standard components from appropriate industrial manufacturers is emphasized.

Offered:	Winter Semester
Credit:	4
In-Class Workload:	4 hours Lecture, 1 hour Seminar
Out-of-Class Workload:	5 hours
Prerequisites:	MENG 253 and MENG 273

Objectives:

Upon successful completion of this course, the student should be able to:

1. Graphically and analytically determine the maximum shear and principal stresses in a plane from the given stresses.
2. Determine the probability of failure according to various failure theories.
3. Understand the principles behind fatigue and be able to estimate the lifetime of a part exposed to steady and alternating stresses.
4. Design shafts to handle the applied loads under a variety of applications.
5. Determine the correct screw thread to use for certain applications requiring pre-tensioning or transmission of power.
6. Determine the correct plain bearing and lubricant for a particular application based on the environment and loading of the bearing.
7. Specify the correct type and number of V-belts to satisfy a particular machine design and estimate the shaft centre distance and lifetime of the belts.

8. Determine the generated torque and required actuating force for a variety of different types of clutches and brakes.
9. Perform a force analysis on a spur gear, determine the bending stress, and the dynamic effects, and estimate the tooth and gear lifetime.
10. Design torsion, leaf, and helical springs; and determine the suitable wire material and size.

Outline:	<i>Estimated Hours</i>
1. <i>Principal Stresses and Stress Transformation</i> Mohr's Circle Stress Transformation Principal Stresses Maximum Shear Stress	5
2. <i>Static Failure Theories</i> Types of Static Failures Static Failure Theories Geometric Stress-Concentration Factors	5
3. <i>Designing for Fatigue</i> Endurance Limit of Material, S-N Curves Cumulative Fatigue	5
4. <i>Fatigue Diagrams</i> Steady and Alternating Stresses Introduction to Fatigue Diagrams Stress-Concentration Factors Equivalent Static Stress	5
5. <i>Shafting</i> Power Transmitted; Maximum Static Shearing Stress ASME Code for Shafting Transverse Shear Stress Fluctuating Loads on Shafts Mises-Hencky Theory for Failure Keys and Couplings	5
<i>Midterm #1 – Covers Sections 1, 2, 3 and 4</i>	2
6. <i>Screwed Fasteners</i> Standard Threads, Tolerancing Effect of Initial Tensioning and Fluctuating Loading Power Screw; Torque and Efficiency Stress Due to Impact Loading	8

7.	<i>Belt Drives</i>	5
	Prime mover Size and Service Factor	
	Selection of Correct Size and Number of V-Belts	
	Selection of Appropriate Sheave Size	
	Belt Tension and Lifetime	
8.	<i>Springs</i>	5
	Spring Materials and Wire Sizes	
	Torsion Bar Design	
	Helical Compression and Tension Spring Design	
	Helical Torsion Springs	
<i>Midterm #2 – Covers Sections 4, 5, 6 and 7</i>		2
9.	<i>Plain Bearings</i>	5
	Viscous Shearing Stresses; Petroff's Bearing Equation	
	Hydrodynamic Lubrication, Bearing Characteristic Curves	
	Temperature Rise in Plain Bearings	
	Zn/P curve; Bearing Materials	
	Construction of Bearing	
10.	<i>Design of Gears</i>	5
	Forces on Gear Teeth	
	Stresses in Gear Teeth	
	Gear Materials and Manufacture	
	Selection of Gear Material	
	Lifetime of a Gear Tooth, Gear, or Mating Pair of Gears	
11.	<i>Clutches and Brakes</i>	8
	Introduction to Common Types of Bakes and Clutches	
	Plate Clutches and Brakes	
	Disc Clutches	
	Cone Clutches and Brakes	
	Drum Clutches and Brakes	
	Band Clutches and Brakes	
	Energy Absorption and Heat Dissipation	
	Design Examples Involving Translation and Rotation	
Total Hours:		----- 65

Distribution of Marks:

Assignments	20%
Laboratories	10%
Midterm #1	20%
Midterm #2	20%
Final Exam	30%

	100%

All assignments must be submitted before sitting the final exam.

Grading:

A+	90 -> 100%	B-	70 -> 72%
A	85 -> 89%	C+	65 -> 69%
A-	80 -> 84%	C	60 -> 64%
B+	77 -> 79%	D	50 -> 59%
B	73 -> 76%	F	< 50%

The weighted average of all exams must be over 50% or an I or F will be awarded.

Required Text:

Machine Elements in Mechanical Design
Mott, Vavrek and Wang, 6th Edition, Pearson Publishing

Instructors:

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Office hours will be posted outside our offices and on Desire-2-Learn.

Reference Website:

<http://online.camosun.ca> This course is fully supported by Desire2Learn

Assignments and Laboratories:

No late assignments or labs will be accepted.

Assignments will be reviewed in class shortly after the due date. If identical assignments are handed in, the marks will be divided up equally between the students.
