CONCORDIA UNIVERSITY
FACULTY OF ENGINEERING AND COMPUTER SCIENCE
DEPARTMENT OF MECHANICAL AND INDUSTRIAL ENGINEERING
MECH 344 – MACHINE ELEMENT DESIGN - Winter 2011
COURSE OUTLINE

Instructor Section M:	Dr. S. Narayanswamy, **Office:** EV4-124
Time & Classroom:	M - - - -, 14:45 - 17:30, Classroom: H 431
Office Hours:	- - W - -, 14:00 – 16:00 or **by appointment**
Phone/E-Mail:	514-848-2424 ex.7923 / nrskumar@encs.concordia.ca
Web Site:	http://users.encs.concordia.ca/~nrskumar

Tutorials:

Tutorial class: MA	-T----- 17:45-19:25	Room H-615
Tutor and Marker:	Seyed Sabzevari	sir.msb@gmail.com
Tutorial class: MB	---J--- 17:45-19:25	Room H-427
Tutor and Marker:	Farjad Shadmehri	f_shadme@encs.concordia.ca

TEXTBOOK (Mandatory): "Machine Design– An Integrated Approach" Robert L. Norton, Prentice-Hall Inc., Fourth Edition, 2011.

OBJECTIVES:

This course aims to present the basic principles employed in the design of standard mechanical components subjected to operating force and moment fields. The course will highlight the adaptation of theoretical stress relationships to practical design problems. Tests and examinations will seek to evaluate the ability of the student to apply the generic approaches discussed to real-life mechanical engineering design problems.

GRADUATE ATTRIBUTES:

Problem Analysis: An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.

Design: An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, economic, environmental, cultural and societal considerations.

Machines consist of interrelated elements. This course will focus on design of important conventional machine design elements. Design problems are typically unstructured and various design processes have been developed in an attempt to structure the design problems. In this course, the emphasis would be on detailed design stage of design process in which appropriate mathematical models will be used to analyze the design alternatives.

In this course, the class as a whole will be assessed on the problem analysis and design attributes by means of term tests and final exam.

COURSE PLAN

9-Jan-12	week 1	**Introduction to Design:** Machine Design, Design Process and Safety Factors	1,2,3
16-Jan-12	week 2	**Fundamental Topics from Mechanics of Materials**: Beam Loading; Stress; Strain; Principal Stresses; Plane Stress and Plane Strain; Mohr's Circle; Applied versus Principal Stresses; Direct Shear Stress; Bearing Stress and Tearout; Beams and Bending Stresses; Deflection in Beams; Torsion; Combined Stresses; Stresses in Cylinders	4
23-Jan-12	week 3	**Static Failure Theories:** Failure of Ductile Materials under Static Loading; Failure of Brittle Materials under Static Loading	5
30-Jan-12	week 4	**Fatigue Failure Theories:** Mechanism of Fatigue Failure; Fatigue Failure Models and Machine-Design Considerations; Fatigue Loads; Measuring Fatigue Failure Criteria; Estimating Fatigue Failure Criteria; Notches and Stress Concentrations; Fatigue Failure Theories; Designing for High Cycle Fatigue; Designing for Fully Reversed Uniaxial Stresses; Designing for Fluctuating Uniaxial Stresses; Designing for Multiaxial Stresses in Fatigue	6
6-Feb-12	week 5		
13-Feb-12	week 6	**Design of Shafts and Keys:** Shaft Loads; Attachments and Stress Concentrations; Shaft Materials; Shaft Power; Shaft Loads; Shaft Stresses; Shaft Failure in Combined Loading; Shaft Design; Keys and Keyways; Interference Fits; Critical Speeds of Shafts (Lateral Vibration of Shafts and Beams-Rayleigh's Method; Shaft Whirl)	10
27-Feb-12	week 7		
5-Mar-12	week 8	**Design of Spur Gears:** Gear Tooth Nomenclature; Loading on Spur Gears; Bending and Surface Stresses in Spur Gears; Bending- and Surface- Fatigue Strengths for Gear Materials	12
12-Mar-12	week 9	**Design of Screws and Fasteners:** Standard Thread Forms; Power Screws; Stresses in Threads; Strengths of Standard Bolts and Machines Screws; Preloaded Fasteners in Tension under Static and Dynamic Loading; Determining the Joint Stiffness Factor; Controlling Preload; Fasteners in Shear	15
19-Mar-12	week 10		
26-Mar-12	week 11	**Design of Springs:** Spring Rate; Spring Configurations; Spring Materials; Helical Compression Springs; Designing Helical Compression Springs for Static and Fatigue Loadings	14
2-Apr-12	week 12	**Design of Journal and Rolling-Element Bearings:** Lubricants; Viscosity; Types of Lubrication; Hydrodynamic Lubrication; Design of Hydrodynamic Bearings using Design Charts; Rolling Element Bearings; Failure of Rolling-Element Bearings; Selection of Rolling-Element Bearings	11
10-Apr-12	week 13	Review	

TERM TESTS: Two term tests that will be held during Lecture Hours on the following dates:
Test #1: Monday February 6, 2012 (Closed book) - 10%
Test #2: Monday March 26, 2012 (Open Book-textbook only) - 10%

MIDTERM TEST: will be held during a common tutorial section on the week of 5th march 2012 either on that Tuesday or Thursday. (Open Book-textbook only)- 20%
NOTE: There will be **no make up** for the term tests.

EVALUATION SCHEME:

The course grade will be based on the term tests (total 20%); Midterm Exam (20%) and the final exam (60%).

FINAL EXAMINATION: (60%)

The final exam will be of the "open-book" exam type. It will be three hours long and will be conducted during the University wide examination period. The material for the final exam will cover all the topics discussed during the term. Only the textbook is permitted during the examination.

GENERAL NOTES:

1- In order to pass the course you have to obtain at least 50% of mark from the Final Exam.

2- Electronic communication devices (including cell phones) are not allowed in examination rooms.

3- Only "Faculty Approved Calculators will be allowed in examination rooms.

4- In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change

Some Useful References:

1- J. E. Shigley, C. R. Mischke and R. G. Budynas, “Mechanical Engineering Design,” Ninth Edition, McGraw-Hill, 2010.

2- M. F. Spotts, T. E. Shoup and L. E. Hornberger, “Design of Machine Elements,” Eighth Edition, Prentice-Hall, 2004.

3- R. C. Juvinall and K. M. Marshek, “Fundamentals of Machine Component and Design,” Fourth Edition, Wiley, 2006.

4- B. J. Hamrock, S. R. Schmid and B. Jacobson, “Fundamentals of Machine Elements,” Second Edition, McGraw-Hill, 2005