CONCORDIA UNIVERSITY
FACULTY OF ENGINEERING AND COMPUTER SCIENCE
DEPARTMENT OF MECHANICAL AND INDUSTRIAL ENGINEERING
MECH 344 – MACHINE ELEMENT DESIGN - Winter 2017-18
COURSE OUTLINE

Instructor Section M:	Dr. S. Narayanswamy, **Office:** EV4-189
Time & Classroom:	M - - - -, 14:45 - 17:30, Classroom: H-1070
Office Hours:	M - - - -, 10:00 – 12:00 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 ---J- 17:45-19:25 Room H-429
Tutor and Marker: Swathy Polani, swathyshankar92@yahoo.com
Tutorial class: MB ---J- 17:45-19:25 Room H-607
Tutor and Marker: Faisal Joudah, faisal_.1995@hotmail.com

TEXTBOOK (Mandatory): **"Fundamentals of Machine Component Design"**
Robert C. Juvinall and Kurt M, Marshek, Wiley; 6th edition.

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.

EVALUATION SCHEME:

The course grade will be based on two term tests (total 40%) and the final exam (60%). The format and type of these written examinations are outlined below:

Term Tests: Two term tests will be held on the following dates

Term Test #1: Monday March 5, 2018 (Open Book-textbook only) - 20% - During Lecture
Term Test #2: Thursday April 5, 2018 (Open Book-textbook only) - 20% - During Tutorial

NOTE: There will be **no make up** for the term tests.

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 scheduled in April/May 2018. 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- Richard G. Budynas and Keith Nisbett, "Shigley's Mechanical Engineering Design," 10th Edition, McGraw-Hill, 2014.

2- M. F. Spotts, T. E. Shoup and L. E. Hornberger, "Design of Machine Elements," 8th Edition, Prentice-Hall, 2004.

3- Robert L. Norton, "Machine Design– An Integrated Approach," 5th Edition, Prentice Hall, 2013.

4- S. R. Schmid, B. J. Hamrock, and B. Jacobson, "Fundamentals of Machine Elements," 3rd Edition, CRC press, 2013.

COURSE PLAN

8-Jan	week 1	**Introduction to Design:** An overview of the subject, Machine Design Process	-
15-Jan	week 2	**Fundamental Topics from Mechanics of Materials**: Stresses due to Axial, Bending, Direct Shear, Transverse Shear and Torsional Loadings; Curved Beams; Combined Stresses- Mohr Circle; Stress Concentration Factors; Residual Stresses; Thermal Stresses	4 (must be reviewed by students)
22-Jan	week 3	**Static Failure Theories:** Failure of Ductile Materials under Static Loading (Maximum Shear Stress Theory, Maximum Distortion Energy Theory); Failure of Brittle Materials under Static Loading (Modified Mohr Theory)	6 (6.5-6.12)
29-Jan	week 4	**Fatigue Failure Theories:** Basic Concepts and Standard fatigue Test; Fatigue Strengths for Reversed Bending, Reversed Axial Loading and Reversed Torsional Loading; Fatigue Strength for Reversed Biaxial Loading; Influence of Surface and Size on Fatigue Strength; Effect of Mean Stress on Fatigue Strength; Effect of Stress Concentration; Fatigue Life Prediction with Randomly Varying Loads	8 (8.1-8.12)
5-Feb	week 5		
12-Feb	week 6	**Design of Screws and Fasteners:** Thread Forms, Terminology and Standards; Power Screws; Screw Stresses; Threaded Fasteners; Fasteners Materials and Methods of Manufacture; Bolt Tightening and Initial Tension; Bolt Tension with External Joint-Separating Force; Bolt Selection for Static Loading; Bolt Selection for Fatigue Loading	10
26-Feb	week 7		
5-Mar	week 8*	**Design of Springs:** Coil Spring Stress and Deflection; Stress and Strength Analysis for Helical Compression Springs-Static Loading; End Designs of Helical Compression Springs; Bucking Analysis of Helical Compression Springs; Design Procedure for Helical Compression Springs-Static Loading; Design of Helical Compression Springs for Fatigue Loading	12 (12.1-12.8)
12-Mar	week 9	**Design of Shafts and Keys:** Shaft Loads; Attachments and Stress Concentrations; Shaft Stresses; Rotating-Shaft Dynamics; Overall Shaft Design; Keys	17 (17.1-17.6)
19-Mar	week 10	**Design of Spur Gears:** Geometry and Nomenclature; Interference and Contact Ratio; Gear Force Analysis; Gear-Tooth Strength; Gear-Tooth Bending Fatigue Analysis- Basic Concepts and Recommended Procedure; Gear Tooth Surface Fatigue Analysis-Basic Concepts and Recommended Procedure	15 (15.1-15.12)
26-Mar	week 11		
9-Apr	week 12	**Design of Journal and Rolling-Element Bearings:** Rolling-Element Bearing Types; Fitting of Rolling-Element Bearings; Catalogue Information for Rolling-Element Bearings; Bearing Selection based on Fatigue Life Requirement	14
16-Apr	week 13	Review	
5^{th} March, Term Test 1 will be during lecture, and 5^{th} April Term Test 2 will be during Tutorial			