STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK

MASTER SYLLABUS

COURSE NUMBER – COURSE NAME
MECH 232 – Machine Design

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Canino School of Engineering Technology

Department: Mechanical & Energy Technologies

Semester/Year: 2022

A. **TITLE**: Machine Design

B. **COURSE NUMBER:** MECH 232

C. **CREDIT HOURS: (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)**

 # Credit Hours: 3
 # Lecture Hours: 2 **per week**
 # Lab Hours: **per week**
Other: 2 hours recitation **per week**

Course Length: 15 **Weeks**

D. **WRITING INTENSIVE COURSE**: Yes ☐ No ☒

E. **GER CATEGORY: None:** ☒ **Yes:** GER
***If course satisfies more than one*:** GER

F. **SEMESTER(S) OFFERED: Fall** ☐ **Spring** ☒ **Fall & Spring** ☐

G. **COURSE DESCRIPTION:**

Design of machine elements subjected to static, dynamic and fluctuating loads. Theory includes design and analysis of beams, columns, shafts, mechanical power transmission devices. Stress concentration factors, Goodman A design project is required for the course. The recitation session will be used for solving numerical problems and for consultation on the semester design project.

H. **PRE-REQUISITES: None** ☐ **Yes** ☒ **If yes, list below:**

CONS 272 or ENGS 203 or permission from instructor

CO-REQUISITES: None ☒ **Yes** ☐ **If yes, list below:**

I. STUDENT LEARNING OUTCOMES: (*see key below*)

By the end of this course, the student will be able to:

Course Student Learning Outcome [SLO]	***Program Student Learning Outcome [PSLO]***	***GER*** *[If Applicable]*	***ISLO & SUBSETS***	
1. Solve fundamental machine element problems to standard engineering format.			5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
2. Solve problems that have compression, tensile, torsion, and/or eccentric loads.			5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
3. Apply Mohr's Circle concept for combined stresses			5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
4. Determine the allowable load that can be applied to long and short columns			5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
5. Determine the endurance strength and design members subject to fluctuating loads.			5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
6. Design a load carrying shaft with keys or couplings.			2-Crit Think ISLO ISLO	Subsets Subsets Subsets Subsets

7. Evaluate a mechanical drive system using belts, chains drives or gears.			2-Crit Think ISLO ISLO	Subsets Subsets Subsets Subsets
8. Apply a variety of failure theories to a design analysis.			5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
9. Rcognize and report the ethical and social responsiblities for a mechanical designer			4-Soc Respons ISLO ISLO	Subsets Subsets Subsets Subsets
			ISLO ISLO ISLO	Subsets Subsets Subsets Subsets

KEY	**Institutional Student Learning Outcomes [ISLO 1 – 5]**
ISLO #	**ISLO & Subsets**
1	**Communication Skills** Oral [O], Written [W]
2	**Critical Thinking** *Critical Analysis [CA] , Inquiry & Analysis [IA] , Problem Solving [PS]*
3	**Foundational Skills** *Information Management [IM], Quantitative Lit,/Reasoning [QTR]*
4	**Social Responsibility** *Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]*
5	**Industry, Professional, Discipline Specific Knowledge and Skills**

*Include program objectives if applicable. Please consult with Program Coordinator

J. APPLIED LEARNING COMPONENT: Yes ☒ No ☐

If YES, select one or more of the following categories:

- ☒ Classroom/Lab
- ☐ Internship
- ☐ Clinical Placement
- ☐ Practicum
- ☐ Service Learning
- ☐ Community Service
- ☐ Civic Engagement
- ☐ Creative Works/Senior Project
- ☐ Research
- ☐ Entrepreneurship (program, class, project)

K. TEXTS:

Mott, Robert L. (2013) Machine Elements in Mechanical Design (5th Edition), Prentice-Hall,Inc.

L. REFERENCES:

Machinery's Handbook, 26th edition, Industrial Press
Design of Machine Elements by Spotts and Shoup, 7th edition, Prentice Hall
Mechanical Engineering Design by Shigley, 6th edition, Prentice Hall
Static and Dynamics by Hibbler, 9th edition, Prentice Hall

M. EQUIPMENT: None ☐ **Needed:** The use of the Material Testing Lab (NS110) and Machine shop (NS106) are required

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

Unit Exams = 35 %
Final Exam = 15 %
Homework/Quizzes = 15 %
Recitation Assignments/Design Projects = 35%

P. DETAILED COURSE OUTLINE:

I. Introduction
- **A. Design Process and Calculations**
- **B. Basic Sizes and Units**
- **C. Design Functions and Requirements**
- **D. Material (Ferrous, Non Ferrous, Composites) Properties**
- **E. Material Selection**

II. Stress and Deformation Analysis
- **A. Direct Shear**
- **B. Torsional Shear**

C. **Tensile and Compression**
D. **Bending**
E. **Beam Deflection**
F. **Concentrated Bending Moments**
G. **Stress Concentrations**
H. **Combined Normal Stresses**

III. Combined Stresses and Mohr's circle
A. **Application and use for Mohr's Circle**
B. **Principal Stress Element**
C. **Drawing and Interpreting the Circle**

IV. Design for Different Types of Loading
A. **Identifying Loading Conditions and Stress Ratio**
B. **Endurance Strength and Fatigue Failure**
C. **Estimated Endurance Strength**
D. **Design Factors**
E. **Prediction of Failure Analysis**

V. Column Design
A. **Column Analysis**
B. **Euler and Johnson Formula**
C. **Spreadsheet Design and Analysis of Columns**

VI. Belt and Chain Drives
A. **Type of Belt Drives**
B. **Belt Drive Design**
C. **Chain Drive Design**

VII. Gears
A. **Type of Gears**
B. **Gear Nomenclature**
C. **Gear Train Ratios and Design**
D. **Forces Developed in Gears**

Q. <u>LABORATORY OUTLINE</u>: None ☒ Yes ☐

I. The recitation time is setup to provide time for students to solve more complex and time consuming problems than is practical for homework. The assignments tie in with the unit topic for that week.

II. Students work in teams to design a solution to a selected problem they choose. Examples include, but are not limited to (car jack, portable crane, transfer device, carton packer, oscillating spindle sander, robot gripper, chain conveyor)