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


# MASTER SYLLABUS

## COURSE NUMBER – COURSE NAME
## PHYS 330 - INTRODUCTION TO CLASSICAL MECHANICS

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**Canino School of Engineering Technology !**

**Department: PHYSICS !**

**Semester/Year: FALL/2018 !**

**A.** **TITLE**: INTRODUCTION TO CLASSICAL MECHANICS

**B.** **COURSE NUMBER:** PHYS 330

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

**# Credit Hours:** 3
**# Lecture Hours:** 3 **per week**
**# Lab Hours:** **per week**
**Other:** **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:**

This course is a presentation of Newtonian mechanics at the intermediate level. Topics include dynamics of particles and rigid bodies, rotating reference frames, conservation laws, gravitational fields and potentials, planetary motion, wave motion, oscillations, LaGrangian and Hamiltonian equations.

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

University Physics II or College Physics II; Calculus II; or permission of the 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*** | |
|---|---|---|---|---|
| a. Analyze the world around them from a physics point of view; Contrast fundamental concepts of mechanics. | N/A | N/A | 1-Comm Skills<br>2-Crit Think<br>5-Ind, Prof, Disc, Know Skills | W<br>CA<br>Subsets<br>Subsets |
| Apply mechanics to situations in the everyday world. | N/A | N/A | 1-Comm Skills<br>2-Crit Think<br>5-Ind, Prof, Disc, Know Skills | W<br>PS<br>Subsets<br>Subsets |
| Apply classical mechanics equations to solving practical problems. | N/A | N/A | 1-Comm Skills<br>2-Crit Think<br>5-Ind, Prof, Disc, Know Skills | W<br>PS<br>Subsets<br>Subsets |
| State Kepler's laws of planetary motion and relate its importance. | N/A | N/A | 1-Comm Skills<br>2-Crit Think<br>5-Ind, Prof, Disc, Know Skills | W<br>PS<br>Subsets<br>Subsets |
| Research, write and present a paper on a related topic. | N/A | N/A | 1-Comm Skills<br>2-Crit Think<br>5-Ind, Prof, Disc, Know Skills | W<br>CA<br>Subsets<br>Subsets |

| **KEY** | **Institutional Student Learning Outcomes [ISLO 1 – 5]** |
|---|---|
| **ISLO #** | **ISLO & Subsets** |
| **1** | **Communication Skills**<br>Oral [O], Written [W] |
| **2** | **Critical Thinking**<br>*Critical Analysis [CA] , Inquiry & Analysis [IA] , Problem Solving [PS]* |
| **3** | **Foundational Skills**<br>*Information Management [IM], Quantitative Lit,/Reasoning [QTR]* |
| **4** | **Social Responsibility**<br>*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 | ☐ Civic Engagement |
| ☐ Internship | ☐ Creative Works/Senior Project |
| ☐ Clinical Placement | ☐ Research |
| ☐ Practicum | ☐ Entrepreneurship (program, class, project) |
| ☐ Service Learning | |
| ☐ Community Service | |

**K. TEXTS:**

Goldstein, Herbert & Poole Charles & Safko, John (2002). Classical Mechanics. Reading, MA: Addison-Wesley Publication.

**L. REFERENCES:**

None

**M. EQUIPMENT: None** ☐ **Needed:** Technology enhanced classroom

**N. GRADING METHOD:** A-F

**O. SUGGESTED MEASUREMENT CRITERIA/METHODS:**

- **Exams**
- **Quizzes**
- **Homework**
- **Participation**
- **Project/Presentation**

**P. DETAILED COURSE OUTLINE:**

**I. Newtonian Mechanics in One Dimension**
- **A. Newton's laws and inertial system**
- **B. Simple applications of Newton's laws**
- **C. Constant applied force**
- **D. Position-dependent forces; Time-dependent force; Velocity-dependent force.**

**II. Oscillations - Linear restoring force**
- **A. Linear restoring force**
- **B. Harmonic motion, Damped harmonic motion, Forced harmonic motion.**

**III. Mechanics of Rigid Bodies**
- **A. Center of mass of a rigid body.**
- **B. Rotation about a fixed axis.**
- **C. Calculation of moment of inertia.**
- **D. The physical pendulum.**
- **E. Laminar motion of a rigid body.**

**IV. Dynamics of Systems of Particles**

- **A. Center of mass and linear momentum of a system.**
- **B. Angular momentum and kinetic energy of a system.**
- **C. Motion of two interacting bodies. Collisions.**
- **D. Oblique collisions and scattering.**

**V. General Motion of a Particle in Three Dimensions**

- **A. General principles.**
- **B. Potential energy function in three-dimensional motion: the Del operator.**
- **C. Projectile motion.**
- **D. The harmonic oscillator in two and three dimensions.**
- **E. Motion of charged particles electric and magnetic fields.**
- **F. Constrained motion of a particle.**

**VI. Non-inertial Coordinate Systems**

- **A. Accelerated coordinate systems and inertial forces.**
- **B. Rotating coordinate systems.**
- **C. Dynamics of a particle in a rotating coordinate system.**
- **D. Effects of Earth's rotation.**
- **E. The Foucault pendulum.**

**VII. Gravitation and Central Forces**

- **A. Gravitational force between a uniform sphere and a particle.**
- **B. Kepler's laws of planetary motion.**
- **C. Potential energy in a gravitational field.**
- **D. Energy equation of an orbit in a central field.**
- **E. Orbital energies in an inverse-square field.**
- **F. Effective potential.**

**VIII. Lagrangian Mechanics**

- **A. Hamilton's variational principle.**
- **B. Generalized coordinates.**
- **C. Lagrange's equations of motion for conservative systems.**
- **D. Generalized momenta. Ignorable coordinates.**
- **E. Forces of constraint.**
- **F. Lagrange multipliers.**
- **G. Generalized forces.**
- **H. Hamilton's equations.**

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