COLLEGE OF THE DESERT

Course Code PH-012

Course Outline of Record

1. Course Code: PH-012
2. a. Long Course Title: Dynamics
   b. Short Course Title: DYNAMICS
3. a. Catalog Course Description:
   This course is intended for physics majors planning to transfer to four-year institutions. It covers the fundamentals of kinematics and kinetics of particles and rigid bodies. Topics include kinematics of particle motion, Newton's second law, planar and three dimensional motion of rigid bodies, momentum and energy principles for rigid body motion and an introduction to vibrations and oscillations. (Equivalent to Engr 12).
   b. Class Schedule Course Description:
   Vector treatment of systems of particles and rigid bodies. Applications of Newton's second law and the principles of work-energy and impulse-momentum in one,two and three-dimensions.
   c. Semester Cycle (*if applicable*): This course is taught every spring
   d. Name of Approved Program(s):
   - LIBERAL ARTS with emphasis in Math and Science AA Degree and Transfer Preparation
4. Total Units: 3.00 Total Semester Hrs: 54.00
   Lecture Units: 3 Semester Lecture Hrs: 54.00
   Lab Units: 0 Semester Lab Hrs: 0
   Class Size Maximum: 35 Allow Audit: No
   Repeatability No Repeats Allowed
   Justification 0
5. Prerequisite or Corequisite Courses or Advisories:
   Course with requisite(s) and/or advisory is required to complete Content Review Matrix (CCForm1-A)
   Prerequisite: PH 011 with a minimum grade of C or
   Prerequisite: ENGR 011 with a minimum grade of C
6. Textbooks, Required Reading or Software: *(List in APA or MLA format.)*
   a. Beer, F. and Johnston, E. (2016). *Vector Mechanics for Engineers* (11th/e). Boston McGraw Hill. ISBN: 0073398242
   College Level: Yes
   Flesch-Kincaid reading level: 13.5
7. Entrance Skills: *Before entering the course students must be able:*
   a. Define statics and how it differs from dynamics, know the statements of Newton's 3 laws, know the SI and English systems of units and how to convert from one to another, and know how to round numbers to specified significant figures.
   - ENGR 011 - Define statics and how it differs from dynamics, know the statements of Newton's 3 laws, know the SI and English systems of units and how to convert from one to another, and know how to round numbers to specified significant figures.
   - PH 011 - Define statics and how it differs from dynamics, know the statements of Newton's 3 laws, know the SI and English systems of units and how to convert from one to another, and know how to round numbers to specified significant figures.

   b. Define vectors using scalar and using vector approaches, know how to add vectors and obtain a resultant, and know how to find the angle between two vectors and find the components of a vector along different specified directions.
   - PH 011 - Define vectors using scalar and using vector approaches, know how to add vectors and obtain a resultant, and know how to find the angle between two vectors and find the components of a vector along different specified

directions.
- ENGR 011 - Define vectors using scalar and using vector approaches, know how to add vectors and obtain a resultant, and know how to find the angle between two vectors and find the components of a vector along different specified directions.

c. Construct the free body diagram of a particle and a system and know how to find forces in systems composed of springs, cables and pulleys.
- ENGR 011 - Construct the free body diagram of a particle and a system and know how to find forces in systems composed of springs, cables and pulleys.
- PH 011 - Construct the free body diagram of a particle and a system and know how to find forces in systems composed of springs, cables and pulleys.

d. Compute a moment created by a force, and know how to reduce a system of forces into a single force at a location
- PH 011 - Compute a moment created by a force, and know how to reduce a system of forces into a single force at a location.
- ENGR 011 - Compute a moment created by a force, and know how to reduce a system of forces into a single force at a location.

e. Determine the external reactions for a system in equilibrium and the internal forces for a system in equilibrium.
- ENGR 011 - Determine the external reactions for a system in equilibrium and the internal forces for a system in equilibrium.
- PH 011 - Determine the external reactions for a system in equilibrium and the internal forces for a system in equilibrium.

f. Analyze simple trusses, beams, frames, and simple machines
- PH 011 - Analyze simple trusses, beams, frames, and simple machines.
- ENGR 011 - Analyze simple trusses, beams, frames, and simple machines.

g. Compute internal forces in beams, construct shear and bending moment diagrams of beams, determine forces in cables subjected to concentrated and uniform loads, and know how to account for dry friction.
- PH 011 - Compute internal forces in beams, construct shear and bending moment diagrams of beams, determine forces in cables subjected to concentrated and uniform loads, and know how to account for dry friction.
- ENGR 011 - Compute internal forces in beams, construct shear and bending moment diagrams of beams, determine forces in cables subjected to concentrated and uniform loads, and know how to account for dry friction.

h. Determine the center of gravity, center of mass, and centroid.
- ENGR 011 - Determine the center of gravity, center of mass, and centroid.
- PH 011 - Determine the center of gravity, center of mass, and centroid.

i. Determine the moment of Inertia for uniform and composite areas, find the moment of inertia for areas by integration, and determine the mass moment of inertia.
- PH 011 - Determine the moment of Inertia for uniform and composite areas, find the moment of inertia for areas by integration
- ENGR 011 - Determine the moment of Inertia for uniform and composite areas, find the moment of inertia for areas by integration

8. Course Content and Scope:

Lecture:

1. Rectilinear Motion
2. Curvilinear Motion
3. Newton's Second Law of Motion
4. Work and Energy
5. Impulse and Momentum
6. Impact
7. Kinetics of Systems of Particles
8. Kinematics of Rigid Bodies: Translation, Rotation, and Plane Motion
9. D'Alembert's Principle
10. Kinetics of Plane Motion

11. Impulse-Momentum for Rigid Bodies
12. General Motion
13. Introduction to Vibration

Lab: *(if the "Lab Hours" is greater than zero this is required)*

9. Course Student Learning Outcomes:
   1. Demonstrate qualitative and quantitative understanding of Newtonian Physics and basic equations underlying kinematics and kinetics of rigid bodies in 2D and 3D motion.
   2. Apply these skills to isolate rigid bodies and draw clear and appropriate free-body diagrams and solve 2-D and 3-D kinematics and dynamics problems.
   3. Demonstrate an understanding of conservation laws/principles in mechanics i.e., Law of conservation of energy, Law of conservation of Momentum (both linear and angular) and apply these principles as an alternative method to Newton's laws of motion in solution of dynamics problems.

10. Course Objectives: *Upon completion of this course, students will be able to:*
    a. Derive equations for position, velocity and acceleration of a particle in cartesian coordinates.
    b. Express the two-dimensional curvilinear motion of a particle in rectangular, normal-tangential, and polar coordinates.
    c. Apply Newton's second law to determine the acceleration of a particle and all the forces acting on it.
    d. Computer the work done by forces acting on a moving particle
    e. Apply work-energy principles to determine the motion of a particle or a system of particles.
    f. Apply impulse-momentum methods to determin motion of a particle or a system of particles.
    g. Analyze problems involving collisions of particles.
    h. Compute angular position, angular velocity and angular acceleration of a rigid body in rotational motion.
    i. Apply the method of instantaneous centers to analyze velocities of rigid bodies in general plane motion.
    j. Analyze relative and absolute velocities and accelerations in a regidn body in plane motion.
    k. Compute velocities and accelerations involving rotating coordinate systems.
    l. Apply D'Alemberts principle to determine accelerations and forces in rigid-body plane motion.
    m. Apply energy and momentum methods on rigid bodies in plane motion
    n. Solve problems for undamped and damped harmonic motion.

11. Methods of Instruction: *(Integration: Elements should validate parallel course outline elements)*
    a. Discussion
    b. Lecture
    c. Participation

12. Assignments: *(List samples of specific activities/assignments students are expected to complete both in and outside of class.)*
    In Class Hours: 54.00
    Outside Class Hours: 108.00
    a. In-class Assignments
       Class discussion
       Problem solving and sharing
    b. Out-of-class Assignments
       Reading assignments
       Homework assignments
       Maintain a comprehensive notebook documenting all course work

13. Methods of Evaluating Student Progress: *The student will demonstrate proficiency by:*
    - Written homework
      Weekly problem assignments
    - Guided/unguided journals
      Comprehensive notebook/journal documenting all work, including lecture notes, in-class activities, and homework

assignments.

- Group activity participation/observation
  Student design project will be assigned a group activity requiring a signficant amount of student interaction.
- Mid-term and final evaluations
  Multiple exams and a comprehensive final exam
- Student participation/contribution
  Class participation includes discussion of the application of lecture material, sharing of solutions of various problems, and progress reports of their team design project.

14. Methods of Evaluating: Additional Assessment Information:

15. Need/Purpose/Rationale -- *All courses must meet one or more CCC missions.*
    PO-GE C1-Natural Sciences
    Use college-level mathematical concepts and methods to understand, analyze, and explain issues in quantitative terms.
    IO - Scientific Inquiry
    Analyze quantitative and qualitative information to make decisions, judgments, and pose questions.
    IO - Critical Thinking and Communication
    Apply principles of logic to problem solve and reason with a fair and open mind.

16. Comparable Transfer Course

University System	Campus	Course Number	Course Title	Catalog Year
CSU	California Polytechnic University, Pomona	ME 215	Vector Dynamics	2009
CSU	California Polytechnic University, San Luis Obispo	ME 212	Engineering Dynamics	2010
UC	UC Irvine	MAE 80	Dynamics	2010

17. Special Materials and/or Equipment Required of Students:
    None.

18. Materials Fees: ☐ Required Material?

Material or Item	Cost Per Unit	Total Cost

19. Provide Reasons for the Substantial Modifications or New Course:

    Update textbook and review entire outline

20. a. Cross-Listed Course *(Enter Course Code)*: ENGR-012
    b. Replacement Course *(Enter original Course Code)*: *N/A*

21. Grading Method *(choose one)*: Letter Grade Only

22. MIS Course Data Elements
    a. Course Control Number [CB00]: CCC000533965
    b. T.O.P. Code [CB03]: 190200.00 - Physics, General
    c. Credit Status [CB04]: D - Credit - Degree Applicable
    d. Course Transfer Status [CB05]: A = Transfer to UC, CSU
    e. Basic Skills Status [CB08]: 2N = Not basic skills course
    f. Vocational Status [CB09]: Not Occupational
    g. Course Classification [CB11]: Y - Credit Course

h. Special Class Status [CB13]: N - Not Special
i. Course CAN Code [CB14]: *N/A*
j. Course Prior to College Level [CB21]: Y = Not Applicable
k. Course Noncredit Category [CB22]: Y - Not Applicable
l. Funding Agency Category [CB23]: Y = Not Applicable
m. Program Status [CB24]: 1 = Program Applicable

Name of Approved Program *(if program-applicable)*: LIBERAL ARTS with emphasis in Math and Science
Attach listings of Degree and/or Certificate Programs showing this course as a required or a restricted elective.)

23. Enrollment - Estimate Enrollment
First Year: 15
Third Year: 25

24. Resources - Faculty - Discipline and Other Qualifications:
a. Sufficient Faculty Resources: Yes
b. If No, list number of FTE needed to offer this course: *N/A*

25. Additional Equipment and/or Supplies Needed and Source of Funding.
None.

26. Additional Construction or Modification of Existing Classroom Space Needed. *(Explain:)*
None.

27. FOR NEW OR SUBSTANTIALLY MODIFIED COURSES
Library and/or Learning Resources Present in the Collection are Sufficient to Meet the Need of the Students Enrolled in the Course: Yes

28. Originator Carl Farmer Origination Date 02/08/18