Douglas College

Course Information

A: Division: INSTRUCTIONAL

DATE: May 27, 1997

B: Department: SCIENCE & TECHNOLOGY

New Course: _____

Revision of Course Information form: X

DATED: September 20, 1991

C: PHYS 170 (Subject & Course No.) D: MECHANICS for APPLIED SCIENCE (Descriptive Title) E: 3 (Semester Credit)

F: Calendar Description

This course is intended for students proceeding to studies in Applied Science/Engineering. Topics include statics of particles, rigid body forces and equilibrium, friction, particle kinematics and dynamics, systems of particles.

Summary of Revisions:
(Enter date & section)
Ex: Section C,E,F, &R

1997-05-29

H

G: Type of Instruction: Hours Per Week/ Per Semester

Lecture	3	Hrs.
Laboratory		Hrs.
Seminar		Hrs.
Clinical Experience		Hrs.
Field Experience		Hrs.
Practicum		Hrs.
Shop		Hrs.
Studio		Hrs.
Student Directed Learning		Hrs.
Other (Problems Session)	1	Hrs.

TOTAL 4 HOURS

H: Course Prerequisites:
Physics 12 (C or higher) or PHYS 107

I: Course Corequisites: MAT 120 must precede or be taken concurrently

J: Course for which this course is a pre-requisite

K: Maximum Class Size:
36

L: College Credit Transfer X

College Credit Non-Transfer _____

M: Transfer Credit:
Requested ___
Granted X
Specify Course Equivalents or Unassigned Credit as Appropriate

U.B.C. PHYS 170
S.F.U. MATH 262
U. Vic. PHYS 122
OTHER:

COURSE DESIGNER(S)

D. Wilson
DEAN

VICE PRESIDENT (INSTRUCTION)

P. H. Angus
REGISTRAR

N: Textbooks and materials to be purchased by students
(Use Bibliographic Form):

Hibbeler, R.C., Engineering Mechanics:Statics and Dynamics, 6th Edition, MacMillan, 1992

Complete Form with Entries Under the Following Headings:

O. Course Objectives; P. Course Content; Q. Method of Instruction;

R. Course Evaluation

O. **Course Objectives:**

The student will be able to:

1) analyze two and three dimension concurrent force systems acting upon particles in equilibrium
2) analyze the equilibrium of rigid bodies in two and three dimensions and determine equivalent systems of forces
3) apply the laws of friction to practical problems
4) analyze motion of particles and particle-like objects and systems using displacement, velocity, acceleration, force, Newton's second law, energy, momentum, conservation principles.

P. **Course Content**

1. Statics of Particles
Forces in a Plane
1.1 Force on a Particle;Resultant of Two Forces
1.2 Vectors
1.3 Addition of Vectors
1.4 Resultant of Several Concurrent Forces
1.5 Resolution of a Force into Components
1.6 Rectangular Components of a Force;Unit Vectors
1.7 Addition of Forces by Summing x and y components
1.8 Equilibrium of a Particle
1.9 Newton's First Law of Motion
1.10 Problems Involving the Equilibrium of a Particle; Free Body Diagrams

Forces in Space
1.11 Rectangular Components of a Force in Space
1.12 Force Defined by Its Magnitude and Two Points on Its Line of Action
1.13 Addition of Concurrent Forces in Space
1.14 Equilibrium of a Particle in Space

2. Rigid Bodies: Equivalent Systems of Forces
   - 2.1 External and Internal Forces
   - 2.2 Principle of Transmissibility, Equivalent Forces
   - 2.3 Vector Product of Two Vectors
   - 2.4 Vector Products Expressed in Terms of Rectangular Components
   - 2.5 Moment of a Force about a Point
   - 2.6 Varignon's Theorem
   - 2.7 Rectangular Components of the Moment of Force
   - 2.8 Scalar Product of Two Vectors
   - 2.9 Mixed Triple Product of Three Vectors
   - 2.10 Moment of Force about a Given Axis
   - 2.11 Moment of a Couple
   - 2.12 Equivalent Couples
   - 2.13 Addition of Couples
   - 2.14 Couples Represented by Vectors
   - 2.15 Resolution of a Given Force into a Force at a particular point and a Couple
   - 2.16 Reduction of a system of Forces to One Force and One Couple
   - 2.17 Equivalent Systems of Forces
   - 2.18 Equipollent Systems of Vectors
   - 2.19 Further Reduction of a system of Forces

3. Equilibrium of Rigid Bodies
   - 3.1 Rigid Body in Equilibrium
   - 3.2 Free-Body Diagram
   - 3.3 Reactions at Supports and Connections for a Two-dimensional Structure
   - 3.4 Equilibrium of a Rigid Body in Two Dimensions
   - 3.5 Statically Indeterminate Reactions, Partial Constraints
   - 3.6 Equilibrium of a Two-Force Body
   - 3.7 Equilibrium of a Three-Force Body
   - 3.8 Reactions at Supports and Connections for a Three Dimensional Structure
   - 3.9 Equilibrium of a Rigid Body in Three Dimensions

4. Friction
   - 4.1 The Laws of Dry Friction. Coefficients of Friction
   - 4.2 Angles of Friction
   - 4.3 Problems Involving Dry Friction
   - 4.4 Wedges
   - 4.5 Square-Threaded Screws
   - 4.6 Journal Bearings. Axle Friction
   - 4.7 Thrust Bearings. Disk Friction
   - 4.8 Wheel Friction. Rolling Resistance
   - 4.9 Belt Friction

5. Kinematics of Particles

   Rectilinear Motion of Particles
   - 5.1 Position, Velocity, and Acceleration
   - 5.2 Determination of the Motion of a Particle
   - 5.3 Uniform Rectilinear Motion
   - 5.4 Uniformly Accelerated Rectilinear Motion
   - 5.5 Motion of Several Particles
   - 5.6 Position Vector, Velocity, and Acceleration
   - 5.7 Derivatives of Vector Functions
   - 5.8 Rectangular Components of Velocity and Acceleration
   - 5.9 Motion Relative to a Frame in Translation
   - 5.10 Tangential and Normal Components
   - 5.11 Radial and Transverse Components

6. Newton's Second Law
   - 6.1 Newton's Second Law of Motion
   - 6.2 Linear Momentum of a Particle. Rate of change of Linear Momentum
   - 6.3 International system of Units (SI Units)
   - 6.4 Equations of Motion
   - 6.5 Dynamic Equilibrium
   - 6.6 Angular Momentum of a Particle. Rate of Change of Angular Momentum
   - 6.7 Equations of Motion in Terms of Radial and Transverse Components
   - 6.8 Motion under a Central Force. Conservation of Angular Momentum
   - 6.9 Law of Gravitation
   - 6.10 Kepler's Laws of Planetary Motion

7. Energy and Momentum Methods
   - 7.1 Work of a Force
   - 7.2 Kinetic Energy of a Particle. Principle of Work and Energy
   - 7.3 Applications of the Principle of Work and Energy
   - 7.4 Power and Efficiency
   - 7.5 Potential Energy
   - 7.6 Conservative Forces
   - 7.7 Conservation of Energy
   - 7.8 Motion under a Conservative Central Force. Application to Space Mechanics
   - 7.9 Principle of Impulse and Momentum
   - 7.10 Impulse Motion
   - 7.11 Impact
   - 7.12 Direct Central Impact
   - 7.13 Oblique Central Impact
   - 7.14 Problems Involving Energy and Momentum

8. Systems of Particles
   - 8.1 Application of Newton's Laws to the Motion of a System of Particles. Effective Forces
   - 8.2 Linear and Angular Momentum of a system of Particles
   - 8.3 Motion of the Mass Centre of a System of Particles
   - 8.4 Angular Momentum of a System of Particles about Its Mass Centre
   - 8.5 Conservation of Momentum for a system of Particles
   - 8.6 Kinetic Energy of a System of Particles
   - 8.7 Work-Energy Principle. Conservation of Energy for a System of Particles
   - 8.8 Principle of Impulse and Momentum for a System of Particles
   - 8.9 Variable Systems of Particles
   - 8.10 Steady Stream of Particles
   - 8.11 Systems Gaining or Losing Mass

Q. Method of Instruction

Class time is devoted to lectures and problem solving.

R. Course Evaluation

The final grade assigned for the course will be based upon at least five evaluation components consisting of:

1) final examination - minimum of 20% / maximum of 30%
2) a combination of tests and assignments - minimum of 70% / maximum of 80%