

**ENPHY 131A - Mechanics**

3 Credits, 3 hours lecture. 3 hours lab (every other week), 1 hour tutorial 4.3 Engineering Units for U. Alberta

Kinematics and dynamics of particles, gravitation, work and energy, linear momentum, angular momentum, systems of particles, introduction to dynamics of rigid bodies, accompanied by related laboratory work.

*Prerequisites and/or co-requisites: MATH 100, MATH 101, PHYS 1130, ENGG 130.*

**Instructor**

Jean-Pierre De Villiers

S211B

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**Office Hours**

|           |             |
|-----------|-------------|
| Monday    | 14:00-14:50 |
| Tuesday   | 14:00-14:50 |
| Wednesday | 14:00-14:50 |
| Thursday  | 09:00-09:50 |
| Friday    | 14:00-14:50 |

**Hours of Instruction**

|           |                   |
|-----------|-------------------|
| Monday    | 08:00-10:50 (Lab) |
| Tuesday   | 12:00-12:50       |
| Wednesday | 13:00-13:50       |
| Thursday  | 10:00-10:50       |
| Friday    | 15:00-15:50       |

**Required Resources**

**Engineering Mechanics: Statics and Dynamics**, R.C. Hibbeler. Singapore – Pearson, 2015 (14th edition, with Mastering Engineering)

Engineering notepad for tutorials

Lecture Notebook and separate bound notebook for assignments

**Course Outcomes**

Upon successful completion of this course, the student shall be able to:

- Carry out idealization of a physical system, and know how to set up and solve the equations to solve a dynamics problem.
- Draw a free-body diagram of a rigid body and develop the equations of motion.
- Calculate kinematic equations in different 2D and 3D coordinate systems.
- Apply the techniques of work/energy and impulse/momentum to dynamical problems

## Evaluation

Clearly outline what the students must do in order to pass or complete the course.

|              |      |
|--------------|------|
| Assignments  | 2.5% |
| Tutorials    | 7.5% |
| Labs         | 20%  |
| Midterm Exam | 25%  |
| Final Exam   | 45%  |
| Total        | 100% |

*A grade of C- is required for progression or transfer.*

## Assignments

It is important to start the problems early and not put them off until the day before they are due. This course uses web-based assignments: you will need to use the Mastering Engineering access kit purchased with your textbook to access the assignments; instructions will be provided in the first lecture. Assignments must be completed via the Mastering Engineering web site before the posted due dates; partially completed assignments receive the score achieved before the due date.

- You are expected to keep fully worked out solutions to your assignments in a bound notebook; your instructor may ask to see these solutions at any time, and you should be prepared to produce these solutions when demanded. The best approach is to have your solution book with you during lectures, labs, and tutorials.
- You may rework assignments after the due date for practice purposes; this will have no effect on your score.
- Accurate sketches and correct free body diagrams (FBDs) are a must and are emphasized in all work. The FBD is the single most important tool for the solution of mechanics problems. The important elements of a good problem-solving technique are:
  - correct problem set-up with the assumptions and what is sought,
  - correct analysis with appropriate diagrams,
  - correct numbers and units, and
  - proper interpretation of the solution in both units and directions.
- NOTE: missed or incomplete assignments may result in a grade of F for the course.

## Tutorials

Tutorials are designed to help you develop your problem solving skills by having you work out a complete, written solution to a textbook problem or selected reading from your text under the guidance of your instructor. Assessment of this component will be based on the quality and clarity of the written solution (getting the correct answer is not a significant component of the assessment). Tutorial assignments are due at the end of the tutorial period, unless otherwise indicated. You are expected to work on tutorial problems by yourself, though you may discuss your work with your instructor or a classmate; collaborative solutions are not allowed unless explicitly stated by your instructor.

**Laboratory Work:**

- Students must keep a proper record of experimental results in a hardcover physics laboratory manual (available at bookstore). **IF YOU DO NOT BRING YOUR LOGBOOK TO A LAB, YOU WILL BE EXCUSED FROM THE LAB.**
- Laboratory attendance is compulsory and no unexcused absences will be tolerated. An unexcused absence will result in a grade of zero for the missed lab and may result in course failure. See attendance policy.
- A properly formatted laboratory report produced using Microsoft Word and Excel is to be produced by the due date indicated by your instructor.
- Pre-lab: you are expected to arrive at a lab having read all advance material (posted on iLearn). A pre-lab exercise is due before the start of the lab period. If this exercise is not completed by the deadline, it must be completed during the lab period; the remaining time in the lab period will then be available for the experiment.
- A passing grade must be obtained in the lab portion of the course in order to pass the course. Specifically, students must achieve a 50% or greater aggregate score on lab reports in order to avoid an automatic grade of F. If a passing grade is obtained in the lab component, then a grade is assigned a grade based on term work using the weighting given above.

**Exams**

There will be one midterm exam and a final exam in this course. The midterm exam takes place during a lab period in the seventh week. The midterm will cover all topics covered up to the date of the exam. The two-hour final exam will take place during the exam period at the end of the term. The final exam is a closed book test where you are expected to demonstrate mastery of the subject. You will be expected to solve a set of problems, some similar to work you have previously done, some more challenging. The assignments and labs are designed to help you prepare for this examination, so make sure you take full advantage of these exercises to prepare for the final.

For all exams, you are expected to know fundamental relations and physical laws. No formula sheet will be supplied, although some hints may be given in some problems where a specialized identity or relation may be required. Only simple scientific calculators are allowed during examinations.

**Grading System**

| <b>Descriptor</b>                  | <b>Alpha Grade</b> | <b>4.0 Scale</b> | <b>Percent</b> | <b>Rubric for Letter Grades</b>  |
|------------------------------------|--------------------|------------------|----------------|--|
| Excellent                          | A+                 | 4.0              | > 92.9         | Work shows in-depth and critical analysis, well developed ideas, creativity, excellent writing, clarity and proper format. |
|                                    | A                  | 4.0              | 85 – 92.9      |  |
|                                    | A-                 | 3.7              | 80 – 84.9      |  |
| Good                               | B+                 | 3.3              | 77 – 79.9      | Work is generally of high quality, well developed, well written, has clarity, and uses proper format.                      |
|                                    | B                  | 3.0              | 74 – 76.9      |  |
|                                    | B-                 | 2.7              | 70 – 73.9      |  |
| Satisfactory<br><b>Progression</b> | C+                 | 2.3              | 67 – 69.9      | Work has some developed ideas but needs more attention to clarity, style and formatting.                                   |
|                                    | C                  | 2.0              | 64 – 66.9      |  |
|                                    | C-                 | 1.7              | 60 – 63.9      |  |
| Poor<br><b>Minimum Pass</b>        | D+                 | 1.3              | 55 – 59.9      | Work is completed in a general way with minimal support, or is poorly written or did not use proper format.                |
|                                    | D                  | 1.0              | 50 – 54.9      |  |
| Failure                            | F                  | 0.0              | < 50           | Responses fail to demonstrate appropriate understanding or are fundamentally incomplete.                                   |

**Proposed Schedule of Topics**

| Wk | Chapter                | Main Topics   | Lab/Tutorial           |
|----|------------------------|---|------------------------|
| 1  | 12.1-12.4              | <b>Kinematics of a particle:</b><br>- rectilinear, erratic, curvilinear motion  |                        |
| 2  | 12.5-12.7              | <b>Kinematics of a particle:</b><br>- curvilinear coordinates; projectiles<br>- curvilinear motion: normal/tangential comp. | M2-Non-uniform Motion  |
| 3  | 12.8-12.10             | <b>Kinematics of a particle:</b><br>- cylindrical components, motion of two particles                                       |                        |
| 4  | 13.1-13.4              | <b>Force &amp; Acceleration:</b><br>- Newton's Laws of Motion<br>- Equations of motion, systems of particles                | F3 - Terminal velocity |
| 5  | 13.5-13.6              | <b>Force &amp; Acceleration:</b><br>- Newton's Laws of Motion, coordinate systems   |                        |
| 6  | 14.1-14.4              | <b>Work &amp; Energy:</b><br>- work done by a force, energy, power, efficiency  | M3 - Friction          |
| 7  | Rev 1                  | Family Day; Midterm Review; Midterm   |                        |
| 8  | 14.5-14.6              | <b>Work &amp; Energy:</b><br>- conservative forces and potential energy<br>- conservation of energy                         | M4 - Pulleys           |
| 9  | 15.1-15.3              | <b>Impulse &amp; Momentum:</b><br>- Linear impulse and momentum defined<br>- Cons. of momentum: systems of particles        |                        |
| 10 | 15.4                   | <b>Impulse &amp; Momentum:</b><br>- Collisions  | M5 - Collisions        |
| 11 | 16.1-16.3              | <b>Rigid Body Kinematics:</b><br>- rotational motion<br>- moment of inertia, torque, rotational energy                      |                        |
| 12 | 17                     | <b>Rigid Body Dynamics:</b><br>- rolling motion, Newton's 2nd law, work and power   | M7 - Yo-yo Dynamics    |
| 13 | 18.1-18.3              | <b>Rigid Body Dynamics:</b><br>- energy   |                        |
| 14 | 15.5-15.7<br>19.1-19.3 | <b>Rigid Body Dynamics:</b><br>- angular momentum, precession   |                        |

**Please Note:**

Date and time allotted to each topic is subject to change.

## Performance Requirements

### Student Responsibilities

It is your responsibility as a student to contact the Office of the Registrar to complete the forms for Withdrawal or Change of Registration, and any other forms. Please refer to the list of important dates as noted in the Academic Schedule in the Keyano College credit calendar.

More specific details are found in the Student Rights and Student Code of Conduct section of the Keyano College credit calendar. It is the responsibility of each student to be aware of the guidelines outlined in the Student Rights and Student Code of Conduct Policies.

### Laboratory Safety

In the science laboratories, safety is important.

Students must complete the *WHMIS for Students* online training course on Moodle before entering the science laboratories.

Students must comply with the mandatory laboratory safety rules for this course as provided in the laboratory manual. Failure to do so will result in progressive discipline such as a verbal warning, refused entry into the laboratory, or suspension from the College.

### Student Attendance

Class attendance is useful for two reasons. First, class attendance maximizes a students' learning experience. Second, attending class is a good way to keep informed of matters relating to the administration of the course (e.g., the timing of assignments and exams). Ultimately, you are responsible for your own learning and performance in this course.

It is the responsibility of each student to be prepared for all classes. Students who miss classes are responsible for the material covered in those classes and for ensuring that they are prepared for the next class, including the completion of any assignments and / or notes that may be due.

### Academic Misconduct

Students are considered to be responsible adults and should adhere to principles of intellectual integrity. Intellectual dishonesty may take many forms, such as:

- Plagiarism or the submission of another person's work as one's own
- The use of unauthorized aids in assignments or examinations (cheating)
- Collusion or the unauthorized collaboration with others in preparing work
- The deliberate misrepresentation of qualifications
- The willful distortion of results or data
- Substitution in an examination by another person
- Handing in the same unchanged work as submitted for another assignment
- Breach of confidentiality.

The consequences for academic misconduct range from a verbal reprimand to expulsion from the College. More specific descriptions and details are found in the Student Rights and Student Code of Conduct section of the Keyano College credit calendar. It is the responsibility of each student to be aware of the guidelines outlined in the Student Rights and Student Code of Conduct Policies.

In order to ensure your understanding of the concept of plagiarism, you must successfully complete the online tutorial found on [ilearn.keyano.ca](http://ilearn.keyano.ca). Then print the certificate, sign it, and show it to each of your instructors. Your course work will not be graded until you show this signed certificate.

**Specialized Supports****Counselling and Accessibility Services**

Counselling Services provides a wide range of specialized counselling services to prospective and registered students, including personal, career and academic counselling.

**SKILL Centre**

The SKILL Centre is a learning space in the Clearwater Campus at Keyano College where students can gather to share ideas, collaborate on projects and get new perspectives on learning from our tutorial staff.

The SKILL Centre, through a variety of delivery methods, provides assistance in skill development to Keyano students. Assistance is provided by instructors, staff and student tutors. Individuals wishing to improve their mathematics, writing, grammar, study, or other skills, can take advantage of this unique service.

**Authorization**

This course outline has been reviewed and approved by the Program Chair.

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Jean-Pierre De Villiers, Instructor

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Louis Dingley, Chair

Date Authorized

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Vincella Thompson, Dean

Date Authorized

**Signed copies to be delivered to:**

Instructor

Registrar's Office