Lahore University of Management Sciences

PHY 101 – Mechanics

Fall 2023

To understand how to navigate course outlines, consult: How to Use a Course Outline (http://surl.li/gpvuw)

Instructors	Adam Zaman Chaudhry
Room No.	SSE-9-121A
Office Hours	By Appointment
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Secretary/TA	TBA
TA Office Hours	TBA
Course URL (if any)	
Support Services	LUMS offers a range of academic and other services to support students. These are mentioned below, and you are encouraged to use these in addition to in-class assistance from course staff. For a complete list of campus support services available for you click here (https://advising.lums.edu.pk/#supportservices)

Course Teaching Methodology

- Teaching Methodology: Lectures will be synchronous. Most of the lectures will be in class. However, depending on the instructor's schedule, up to eight lectures may be online (synchronous) via Zoom.

Course Basics				
Credit Hours	4			
Lecture(s)	Nbr of Lec(s) Per Week	2	Duration	110 Minutes
Recitation (per week)	Nbr of Rec (s) Per Week	0	Duration	
Lab (if any) per week	Nbr of Session(s) Per Week		Duration	
Tutorial (per week)	Nbr of Tut(s) Per Week	0	Duration	

Course Distribution	
Core	SSE Core
Elective	None
Open for Student Category	Undergraduate
Closed for Student Category	Grad

COURSE DESCRIPTION

Introduces the principles of classical mechanics. Straight-line kinematics; motion in a plane; relative inertial frames and relative velocity; forces; particle dynamics with force; work, conservative forces, potential energy and conservation of energy; conservation of momentum, center of mass, systems with variable mass; rigid bodies and rotational dynamics; conservation of angular momentum; central force motion; simple harmonic motion

COURSE PREREQUISITE(S)

- Hard work (lots of it please!)

COURSE OBJECTIVES

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	By the end of this course, students should be able to: Explain the motion of moving bodies Explain Newton's laws of motion and its applications in simple scenarios Understand the conservation of energy, linear momentum, and angular momentum

Learning Outcomes	
CLO1	Apply the tools of calculus to analyze the motion of moving bodies
CLO2	Analyze simple situations using Newton's laws
CLO3	Apply the conservation of energy and linear momentum to multiparticle systems
CLO4	Analyze rotational dynamics
CLO5	Analyze simple harmonic motion and periodic behavior

Grading Breakup and Policy
Assignment(s): Home Work Assignments (5 to 6): 15%. Students will have around one week to complete these. The best three will be counted. Quiz(s) (6 to 8): 15%. These will be online and MCQ based using LMS. Attendance: 5%. If students miss up to three lectures, there is no penalty. Every subsequent lecture missed carries a penalty of 1%. Midterm Examination: 30%. Students must submit their solutions within three hours. Final Examination: 40%. Students must submit their solutions within three hours.

Examination Detail	
Midterm Exam	Yes/No: Yes Combine Separate: Combined Duration: 120 to 180 Minutes Preferred Date: End of week 8 Exam Specifications: No books, no notes, no help sheet allowed. Calculators allowed. Formula sheet will be provided.
Final Exam	Yes/No: Yes Combine Separate: Combined Duration: 120 to 180 Minutes Exam Specifications: No books, no notes, no help sheet allowed. Calculators allowed. Formula sheet will be provided.

COURSE OVERVIEW				
Week	Topics	Recommended Readings	Objectives/ Application	CLO
1	Calculus	**Quick Calculus, Chapters 1 and 2**	**To be able to use the concept of differentiation to explain motion**	**CLO 1**
2	Calculus	**Quick Calculus, Chapter 3; Young and Freedman, Chapter 2**	**To be able to use the concept of integration to explain motion**	**CLO 1**
3	Vectors, motion in two and three dimensions	**Young and Freedman, Chapter 3**	**Describe 3D motion using vectors; differentiate and integrate vectors**	**CLO 1**

4-5	Newton's laws of motions and applications	**Young and Freedman, Chapters 4 and 5**	**Use Newton's laws**	**CLO 2**
6	Work and energy	**Young and Freedman, Chapter 6**	**Use work and energy concepts to solve various mechanical problems; understand the usefulness of 'energy'**	**CLO 3**
7	Conservation of energy	**Young and Freedman, Chapter 7**	**Same as previous week**	**CLO 3**
8-9	System of particles, conservation of linear momentum, collisions, rockets	**Young and Freedman, Chapter 8; Kleppner and Kolenkow, Chapter 4**	**Solve the dynamics of systems beyond a simple point particle. Use conservation of linear momentum.**	**CLO 3**
10	Rotation of a rigid body	**Young and Freedman, Chapter 9**	**Understand the basic concepts of rotational kinematics.**	**CLO 4**
11	Dynamics of a rigid body, part I	**Young and Freedman, Chapter 10**	**Solve problems involving rotating objects**	**CLO 4**
12-13A	Dynamics of a rigid body, part II	**Young and Freedman, Chapter 10, Chapter 11 (until and including section 11.3)**	**Solve problems involving both rotations and translations, use angular momentum, analyze equilibrium**	**CLO 4**
13B	Gravitation, Kepler's laws	**Young and Freedman, Chapter 13**	**Understand how Newton came upon the law of gravitation; basic understanding of Kepler's laws**	**CLO 3, 4**
14	Simple harmonic motion	**Wolfson, Chapter 14**	**Understand simple harmonic motion**	**CLO 5**

The above ordering and content may be slightly changed during the course.

Textbook(s)/Supplementary Readings

Basic reading : **Hugh D. Young, Roger A. Freedman and Lewis Ford, University Physics, 12th edition, Addison-Wesley, 2007.**
Nice book with many problems. The more problems you practice, the better you will become. Read the problems in the book at least, and students should focus on those that they think they could not solve.

Richard Wolfson, Essential University Physics, 2nd Edition, Addison-Wesley, 2011.
The book is quite concise and to the point compared to most other freshman physics texts. Students should be able to gain the key concepts without being daunted by the size of the book. The problems are a bit lacking however.

Richard Feynman, Feynman Lectures on Physics, Volume 1. Available online at http://www.feynmanlectures.caltech.edu/I_toc.html
The master explainer at work. Very insightful and contains often very unique exposition. Be warned however – you will need to think a lot!

Daniel Kleppner and Robert Kolenkow, An Introduction to Mechanics, 2nd edition, Cambridge University Press, 2013.
For the extra motivated student out there. Probably the most challenging of all freshman physics books, and certainly not for the faint-hearted. That's not to say that it's an impossible read. Everything is explained very clearly from scratch – the book simply demands a lot of time and patience on the part of the student. The problems are to die for.

Daniel Kleppner, Peter Dourmashkin, and Norman Ramsey , Quick Calculus, 3rd Edition, John Wiley & Sons, 2022.
A great little gem detailing how to use calculus (Ramsey is a Nobel prize winning laureate). Use this to learn calculus quickly or to brush up your skills (you will need this!).

Students are welcome to use some other book of a similar level (for example, Halliday and Resnick, Fundamentals of Physics) that they find easier to learn from.

Throughout the course, supplementary readings shall be provided, as well as additional problems to practice. Coming to the lectures is absolutely essential to do well in the course.

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Campus supports & Key university policies

Campus Supports

Students are strongly encouraged to meet course instructors and TA's during office hours for assistance in course-content, understand the course's expectations from enrolled students, etc. Beyond the course, students are also encouraged to use a variety of other resources. (Instructors are also encouraged to refer students to these resources when needed.) These resources include Counseling and Psychological Services/CAPS (for mental health), LUMS Medical Center/LMC (for physical health), Office of Accessibility & Inclusion/ OAI (for long-term disabilities), advising staff dedicated to supporting and guiding students in each school, online resources (https://advising.lums.edu.pk/advising-resources), etc. To view all support services, their specific role as well as contact information click here (https://advising.lums.edu.pk/#supportservices).

Academic Honesty/Plagiarism

LUMS has zero tolerance for academic dishonesty. Students are responsible for upholding academic integrity. If unsure, refer to the student handbook and consult with instructors/teaching assistants. To check for plagiarism before essay submission, use similarity@lums.edu.pk. Consult the following resources: 1) Academic and Intellectual Integrity (http://surl.li/gpvwb), and 2) Understanding and Avoiding Plagiarism (http://surl.li/gpvwo).

LUMS Academic Accommodations/ Petitions policy

Long-term medical conditions are accommodated through the Office of Accessibility & Inclusion (OAI). Short-term emergencies that impact studies are either handled by the course instructor or Student Support Services (SSS). For more information, please see Missed Instrument or 'Petition' FAQs for students and faculty (https://rb.gy/8sj1h)

LUMS Sexual Harassment Policy

LUMS and this class are a harassment-free zone. No behavior that makes someone uncomfortable or negatively impacts the class or individual's potential will be tolerated.

To report sexual harassment experienced or observed in class, please contact me. For further support or to file a complaint, contact OAI at oai@lums.edu.pk or harassment@lums.edu.pk. You may choose to file an informal or formal complaint to put an end to the offending behavior. You can also call their Anti-Harassment helpline at 042-35608877 for advice or concerns. *For more information: Harassment, Bullying & Other Interpersonal Misconduct: Presentation (http://surl.li/gpvwt)*