

Dynamics

ENGR-240

CG Section 16WK 07/01/2018 to 12/31/2199 Modified 05/17/2022

Course Description

A study of force action related to displacement, velocity and acceleration of particles and rigid bodies using translation and rotation, work and energy and impulse and momentum principles. Course is presented in two parts: the geometric aspects of the motion, or kinematics; and the analysis of forces causing the motion, or kinetics.

Requisites

For information regarding prerequisites for this course, please refer to the [Academic Course Catalog \(https://catalog.liberty.edu/\)](https://catalog.liberty.edu/).

Rationale

This course introduces the student to the principles of dynamics which apply to many engineering problems. The concepts learned on this course assume knowledge of statics. Students are exposed to various realistic engineering problems involving mechanisms, machineries, gear and pulley systems, and fluid stream.

Course Learning Outcomes

Each student will be able to do the following upon successful completion of this course:

- A. Solve kinematics problems that involve rectilinear and curvilinear motion of particles using different coordinates (SOs: 1).
- B. Apply Newton's 2nd Law to systems of particles in rectilinear and curvilinear motion (SOs: 1).
- C. Apply the principles of work and energy, conservation of energy, impulse and momentum, and conservation of momentum to solve engineering problems involving particles and system of particles in motion. (SOs: 1).
- D. Apply impulse and momentum principles to solve problems involving steady mass flow of fluid particles (SOs: 1).
- E. Recognize and solve kinematics and kinetics problems involving a moving reference frame (SOs: 1).
- F. Apply the principles of work and energy, conservation of energy, impulse and momentum, and conservation of momentum to solve engineering problems involving rigid bodies in 2-dimensional motion (SOs: 1, 2, 7).
- G. Recognize and solve problems involving undamped and damped vibrations (SOs: 1, 2, 7).
- H. Describe a biblical worldview of Dynamics and Dynamic Systems (SOs: 3).

Course Resources

Click on the following link to view the required resource(s) for the term in which you are registered: [Liberty University Online Bookstore \(https://bncvirtual.com/liberty/\)](https://bncvirtual.com/liberty/).

Additional Materials for Learning

- A. Computer with basic audio/video output equipment
- B. Internet connection (broadband recommended)
- C. Canvas [recommended browsers \(https://community.canvaslms.com/t5/Canvas-Basics-Guide/What-are-the-browser-and-computer-requirements-for-Canvas/ta-p/66\)](https://community.canvaslms.com/t5/Canvas-Basics-Guide/What-are-the-browser-and-computer-requirements-for-Canvas/ta-p/66)
- D. Microsoft Word

☰ Course Assignments

Textbook Readings

Course Requirements Checklist

After reading the Course Syllabus and [Student Expectations \(https://www.liberty.edu/institutional-effectiveness/student-expectations/\)](https://www.liberty.edu/institutional-effectiveness/student-expectations/), the student will complete the related checklist found in the Course Overview.

Homework Assignments (16)

There is one Homework Assignment each week. All Homework Assignments will be completed on Pearson Mastering and Engineering tool.

Discussions (2)

The student is required to engage in all Discussions. The student is expected to complete both Discussions. Each discussion thread must be at least 250 words, and each reply must be at least 50 words and be supported by at least one scholarly citation.

Quizzes (15)

- i. **Quiz: Expectations on Research Paper:** There is one quiz that is based on the Research Paper Assignment Instructions. The quiz is either multiple choice or T/F questions. The questions in the quiz simply asks you weather you read and understand the expectations of the Research Paper Assignment. Make sure you read the Research Paper Assignment Instructions before attempting this quiz.
- ii. **Quiz: Reading:** There are 10 Quiz Readings covering every topic discussed. The student is expected to read and attempt the quizzes. The quizzes are either multiple choice or T/F questions. The quizzes are all open book/notes and available via Canvas.
- iii. **Quiz: Problem Solving:** There are 4 Quiz Problem Solving. Students are expected to completely solve the problems in these quizzes and select answers from the provided choices as well as upload their solutions. You may also be required to provide short answers to some of the questions.

Research Paper Assignment

Students will be expected to write a research paper on a topic related to faith-integration of engineering mechanics: dynamics. The paper must be 1,500-2,000 words, excluding the bibliography, and include 4-6 scholarly references.

✓ Course Grading

Criteria	Points
Course Requirement Checklist	10
Homework Assignments (12 at 23 points and 4 at 31 points each)	400
Quizzes (15 at varying pts each)	470
Research Paper Assignment	50
Discussions (2 at 40 points each)	80

Total	1010
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* Course Policies

1. Make-up quizzes for an excused reason require prior notice, and the student is expected to take the quiz/test/exam within a week. Quizzes missed for unexcused absences will earn a zero.
2. Excused late Homework Assignments can be accepted. Unexcused late Homework Assignments will earn a reduction of up to 100% based on the late Homework policy stated in Late Assignment Policy section.
3. Consistent or improving performance is encouraged! The professor reserves the right to adjust and curve the final grades based on student effort.
4. **Late Work:** The professor will only accept late work for full credit under extenuating circumstances. Late final project/research paper submissions may not be accepted!
5. **Important Note:** All written schoolwork (exams, reports) that would be uploaded on Canvas should explicitly contain the honor code pledge written and signed or may receive NO CREDIT.

Honor Code Pledge: "I, _____, pledge to uphold God's Biblical mandate that my life testimony demonstrate actions of integrity. In so doing, I will complete this schoolwork as instructed without resorting to cheating or plagiarism". Signature:

Policies

Late Assignment Policy

Course Assignments, including discussions, exams, and other graded assignments, should be submitted on time.

If the student is unable to complete an assignment on time, then he or she must contact the instructor immediately by email.

Assignments that are submitted after the due date without prior approval from the instructor will receive the following deductions:

1. Late assignments submitted within one week after the due date will receive up to a 10% deduction.
2. Assignments submitted more than one week and less than 2 weeks late will receive up to a 20% deduction.
3. Assignments submitted two weeks late or after the final date of the course will not be accepted outside of special circumstances (e.g. death in the family, significant personal health issues), which will be reviewed on a case-by-case basis by the instructor.
4. Group projects, including group discussion threads and/or replies, and assignments will not be accepted after the due date outside of special circumstances (e.g. death in the family, significant personal health issues), which will be reviewed on a case-by-case basis by the instructor.

Disability Assistance

Students with a disability and those with medical conditions associated with pregnancy may contact Liberty University's Online Office of Disability Accommodation Support (ODAS) at LUOODAS@liberty.edu for accommodations. Such accommodations require appropriate documentation of your condition. For more information about ODAS and the accommodations process, including how to request an accommodation, please visit <https://www.liberty.edu/online/online-disability-accommodation-support/> (<https://www.liberty.edu/online/online-disability-accommodation-support/>). Requests for accommodations not related to disabilities or pregnancy must be directed to the Registrar's Office, which generally handles medical needs support.

If you have a complaint related to disability discrimination or an accommodation that was not provided, you may contact ODAS or the Office of Equity and Compliance by phone at (434) 592-4999 or by email at equityandcompliance@liberty.edu. Click to see a full copy of Liberty's [Discrimination, Harassment, and Sexual Misconduct Policy](https://www.liberty.edu/media/1226/Liberty_University_Discrimination_Harassment_and_Sexual_Misconduct_Policy.pdf) (https://www.liberty.edu/media/1226/Liberty_University_Discrimination_Harassment_and_Sexual_Misconduct_Policy.pdf) or the [Student Disability Grievance Policy and Procedures](http://www.liberty.edu/media/8021/Disability_Grievance_Procedures.pdf) (http://www.liberty.edu/media/8021/Disability_Grievance_Procedures.pdf).

Course Attendance

In an effort to comply with U.S. Department of Education policies, attendance is measured by physical class attendance or any submission of a required assignment within the enrollment dates of the course (such as examinations, written papers or projects, any discussion posts, etc.) or initiating any communication with one's professor regarding an academic subject. More information regarding the [attendance policy \(https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwiki.os.liberty.edu%2Fdisplay%2FIE%2FOnline%2BAttendance%2BAnd%2BNon-Attendance&data=02%7C01%7Caccollins2%40liberty.edu%7Cd91431fa6ac547056b5408d833029e1a%7Cbf8218eb3024465a9934a39c97251b2%7C0%7C0%7C637315433613719138&sdata=%2BNBTsPOoXuHAPLfISQRugK7cRSuV6UyC7qD3agf3l2k%3D&reserved=0\)](https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwiki.os.liberty.edu%2Fdisplay%2FIE%2FOnline%2BAttendance%2BAnd%2BNon-Attendance&data=02%7C01%7Caccollins2%40liberty.edu%7Cd91431fa6ac547056b5408d833029e1a%7Cbf8218eb3024465a9934a39c97251b2%7C0%7C0%7C637315433613719138&sdata=%2BNBTsPOoXuHAPLfISQRugK7cRSuV6UyC7qD3agf3l2k%3D&reserved=0) can be found in the [Academic Course Catalogs \(https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.liberty.edu%2Findex.cfm%3FPID%3D791&data=02%7C01%7Caccollins2%40liberty.edu%7Cd91431fa6ac547056b5408d833029e1a%7Cbf8218eb3024465a9934a39c97251b2%7C0%7C0%7C637315433613729132&sdata=DjjhMiRBFnF%2B2ZJUC8eBd1OdNb26S9ADukODYsilXIA%3D&reserved=0\)](https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.liberty.edu%2Findex.cfm%3FPID%3D791&data=02%7C01%7Caccollins2%40liberty.edu%7Cd91431fa6ac547056b5408d833029e1a%7Cbf8218eb3024465a9934a39c97251b2%7C0%7C0%7C637315433613729132&sdata=DjjhMiRBFnF%2B2ZJUC8eBd1OdNb26S9ADukODYsilXIA%3D&reserved=0). Regular attendance in online courses is expected throughout the length of the term. Students who do not attend within the first week of a sub-term by submitting a required academic assignment (such as the Course Requirements Checklist, an examination, written paper or project, discussion post, or other academic activity) will be dropped from the course. Students who wish to re-engage in the course are encouraged to contact Academic Advising to discuss their enrollment options. Students who begin an online course, but at some point in the semester cease attending, and do not provide official notification to withdraw, will be assigned a grade of "FN" ([Failure for Non-Attendance \(https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwiki.os.liberty.edu%2Fdisplay%2FIE%2FUnofficial%2BWithdrawals&data=02%7C01%7Caccollins2%40liberty.edu%7Cd91431fa6ac547056b5408d833029e1a%7Cbf8218eb3024465a9934a39c97251b2%7C0%7C0%7C637315433613729132&sdata=MoMvZdPfa69InuhVHMHAVgu59ZP0Fw45xJTU9PIBrU%3D&reserved=0\)](https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwiki.os.liberty.edu%2Fdisplay%2FIE%2FUnofficial%2BWithdrawals&data=02%7C01%7Caccollins2%40liberty.edu%7Cd91431fa6ac547056b5408d833029e1a%7Cbf8218eb3024465a9934a39c97251b2%7C0%7C0%7C637315433613729132&sdata=MoMvZdPfa69InuhVHMHAVgu59ZP0Fw45xJTU9PIBrU%3D&reserved=0)). Students wishing to withdraw from courses after the official start date should familiarize themselves with the [withdrawal policy](#).

Grading Scale

A	B	C	D	F
900-1010	800-899	700-799	600-699	0-599

For courses with a Pass/NP final grade, please refer to the Course Grading section of this syllabus for the assignment requirements and/or point value required to earn a Passing final grade.

Add/Drop Policy

The full policy statement and procedures are published in the [Policy Directory \(https://wiki.os.liberty.edu/display/IE/Dropping+and+Adding+Online+Classes\)](https://wiki.os.liberty.edu/display/IE/Dropping+and+Adding+Online+Classes).

Honor Code

Liberty University comprises a network of students, Alumni, faculty, staff and supporters that together form a Christian community based upon the truth of the Bible. This truth defines our foundational principles, from our Doctrinal Statement to the Code of Honor. These principles irrevocably align Liberty University's operational procedures with the long tradition of university culture, which remains distinctively Christian, designed to preserve and advance truth. Our desire is to create a safe, comfortable environment within our community of learning, and we extend our academic and spiritual resources to all of our students with the goal of fostering academic maturity, spiritual growth and character development.

Communities are predicated on shared values and goals. The Code of Honor, an expression of the values from which our Doctrinal Statement was born, defines the fundamental principles by which our community exists. At the core of this code lie two essential concepts: a belief in the significance of all individuals, and a reliance on the existence of objective truth.

While we acknowledge that some may disagree with various elements of the Code of Honor, we maintain the expectation that our students will commit to respect and uphold the Code while enrolled at Liberty University.

Adherence to the principles and concepts established within facilitates the success of our students and strengthens the Liberty community.

The Code of Honor can be viewed in its entirety at <http://www.liberty.edu/index.cfm?PID=19155> (<http://www.liberty.edu/index.cfm?PID=19155>).

Schedule

When	Topic	Notes
Course Overview	Student Acknowledgements	Course Requirements Checklist
Module 1	Learn	Read: 8 items Watch: 1 items
	Apply	Homework: Particle Kinematics Using Rectangular Coordinates Assignment Quiz: Expectations on Research Paper
Module 2	Learn	Read: 5 items Watch: 1 item
	Apply	Homework: Particle Kinematics Using Non-Cartesian Coordinates Assignment Quiz: Particle Kinematics
Module 3	Learn	Read: 3 items Watch: 1 item
	Apply	Homework: Particle Kinetics using Rectangular Coordinates Assignment Discussion: Motion of a Projectile Application
Module 4	Learn	Read: 3 items Watch: 1 item
	Apply	Homework: Particle Kinetics using Non-Cartesian Coordinates Assignment Quiz: Particle Kinetics, Force and Acceleration
Module 5	Learn	Read: 2 items Watch: 1 item
	Apply	Homework: Particle Kinetics Using Work & Energy Principle Assignment Quiz: Kinematics and Kinetics of a Particle
Module 6	Learn	Read: 3 items Watch: 1 item
	Apply	Homework: Conservative Forces & Energy Conservation Assignment Quiz: Particle Kinetics Using Work and Energy
Module 7	Learn	Read: 4 items Watch: 1 item
	Apply	Homework: Particle Kinetics, Linear Impulse and Momentum Assignment
Module 8	Learn	Read: 3 items Watch: 1 item

When	Topic	Notes
	Apply	Homework: Particle Kinetics, Angular Impulse and Momentum Assignment Discussion: Linear Impulse and Momentum Application Quiz: Particle Kinetics, Impulse and Momentum
Module 9	Learn	Read: 3 items Watch: 1 item
	Apply	Homework: Rigid Body Kinematics, Translation & Absolute Motion Assignment Quiz: Particle Kinetics, Work/Energy & Impulse/Momentum Principles
Module 10	Learn	Read: 4 items Watch: 1 item
	Apply	Homework: Rigid Body Kinematics, Relative Motion Assignment Quiz: Planar Kinematics of Rigid Body
Module 11	Learn	Read: 3 items Watch: 1 item
	Apply	Homework: Rigid Body Kinetics, Translation Assignment
Module 12	Learn	Read: 3 items Watch: 1 item
	Apply	Homework: Rigid Body Kinetics, Rotation & General Plane Motion Assignment Quiz: Rigid Body Kinetics
Module 13	Learn	Read: 6 items Watch: 2 items
	Apply	Homework: Rigid Body Kinetics, Work & Energy Assignment Homework: Rigid Body Kinetics, Impulse & Momentum Assignment Quiz: Rigid Body Kinetics, Work & Energy Quiz: Planar Kinematics & Kinetics of Rigid Body Quiz: Rigid Body Kinetics, Impulse & Momentum
Module 14	Learn	Read: 5 items Watch: 2 items
	Apply	Homework: Three-Dimensional Rigid Body Kinematics Assignment Homework: Vibrations Research Paper Assignment Quiz: Three-Dimensional Rigid Body Kinematics Quiz: Vibrations Quiz: Planar Kinetics (Work/Energy & Impulse/Momentum), 3D Kinematics, Vibrations