**BME 230: Dynamics (3 Credits)**

**West Chester University, Spring 2022**

**Time: Tuesday and Thursday 8:00 – 9:15 am**

**Location: Science & Engineering Center 107**

# Instructor Information:

Professor: Dr. Nicole Ramo

Email: [nramo@wcupa.edu](mailto:nramo@wcupa.edu) (include “BME230” in the subject line of any emails)

Office Phone: 610-436-2492

Office: SECC 353

Office Hours: Monday 3 – 5 pm, Thursday 10 – 11 am, Friday 2 – 4 pm

Also available by appointment; o*ffice hours may be attended in person or* [*via Zoom*](https://wcupa.zoom.us/my/office.hours.nramo?pwd=WDNvOS9EdVl1ZTRBamVQT2p0elJjQT09)

# Course Description:

BME 230 is a required course in the Biomedical Engineering (BME) major. This course presents the fundamentals of particle and rigid-body dynamics and demonstrates the application of these fundamentals to the systematic solution of engineering mechanics problems. Topics include work, energy, impulse, and momentum; particle motion including kinematic and kinetic analysis; planar motion of rigid-bodies including kinematic and kinetic analysis. If time allows, the three-dimensional motion of rigid-bodies will also be analyzed.

The content of this course builds on mechanics concepts and analysis techniques introduced in PHY 170: Physics I and in BME 220: Statics (e.g., moment of inertia, vector algebra, and free-body diagrams). Please understand that if you struggled in either of these previous courses, success BME 230 may require additional efforts. You are strongly encouraged to reach out for help early and often if needed.

# Course Pre-requisites:

BME 230 requires a prerequisite of BME 220: Statics.

# **Required Materials:**

* **Textbook:** *Engineering Mechanics: Dynamics* by R.C. Hibbeler; Pearson; 15th edition; 2021 (Provided via Inclusive Access through D2L)
* **Scientific Calculator**

# Important Dates:

* First day of class: 1/25/2022
* Add/Drop deadline: 1/31/2022
* **Spring Break (no classes): 3/14/2022 – 3/20/2022**
* Withdrawal deadline: 3/28/2022
* **Final exam: 5/10/2022 8:00am**

# Communication Expectations:

Emails, with BME230 in the subject line, are the preferred way to contact the instructor in this course. Your instructor intends to respond to all student emails within one business day. If you are still waiting on a response after this time frame, please send a follow-up message. **Please note that if you email a question within 24 hours of an assignment deadline, you are not guaranteed a response before your assignment is due; plan accordingly.**

# **D2L Usage:**

All course materials including homework assignments, feedback files, grades, and important communications will be posted on [WCU’s D2L website](https://d2l.wcupa.edu) for the course. ***You are strongly encouraged to set D2L to notify you when new content is posted and when an announcement is made.***

# Attendance Policy:

Consistent and engaged attendance will help you successfully complete this course. You should come to each class meeting prepared to learn and avoid distracting your peers. If you are absent (for excused or unexcused reasons), you will be responsible for any material covered and any announcements that were made in class that day.

# **Course Student Learning Outcomes:**

After successfully completing the BME 230 course, you will be able to:

1. Apply kinematic analysis techniques to analyze the absolute and relative position, velocity, and acceleration of particles and rigid bodies (As assessed by: “Quizzes” and Exams)
2. Apply kinetic analysis techniques, including Equations of Motion, work-energy methods, and impulse-momentum principles, to analyze the motion of particles and rigid bodies (As assessed by: “Quizzes” and Exams)

# Applicable Programmatic / ABET Student Learning Outcomes:

This course will contribute to your *ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics* (Student Outcome 1).

# Meeting & Assessing Student Learning Outcomes:

The following learning activities will help you meet the course learning goals staying engaged during lectures and in-class examples; contributing to and learning from group work; viewing homework assignments as learning opportunities that are important to your success; asking for help early and often if you need it. Your achievement of these learning goals will be assessed primarily by quiz and exam performance as described below.

# Evaluation & Grading:

Your final course grade will be calculated as follows:

* Homework = 10%
* “Quizzes” = 15%
* Exam I = 20%
* Exam II = 20%
* Final Exam = 35%

*This course follows the WCU Final Exam Policy; the final exam is cumulative and mandatory.*

# Homework:

Most homework assignments will be completed using Mastering Engineering, an online personalized-learning tool developed by the textbook publisher. You should treat these assignments as learning opportunities as you will be given **multiple attempts** and your recorded grade will be your best score. More detail will be given in class, but it should be emphasized that if you only have a few attempts remaining and are not sure what you should do differently, send the instructor an email or come to office hours to discuss. Homework deadlines will be posted on D2L; your score will be reduced by 10% for every hour it is late.

# “Quizzes”:

Multiple individual or group in-class “quizzes” will assess how well you paid attention in class, engaged in group work, and treated homework assignments as learning opportunities (i.e., used multiple attempts, if needed, to get the correct answer). These are considered “quizzes” instead of quizzes since they will be a single question and relatively straightforward if you have done the above reasonably well. The dates of the “quizzes” will not be announced in advance; an unexcused absence on the day of a “quiz” will result in a zero.

# ****Exam Policy:****

There will be two exams over the course of the semester as well as a cumulative final exam at the end of the semester. An unexcused absence on the day of an exam will result in a grade of zero for that test. In the case of a university-sanctioned event, please schedule a makeup exam with the instructor in advance of the exam date. If you miss an exam due to a certifiable emergency or illness, please notify the instructor as soon as possible, providing appropriate documentation; in these cases, a makeup exam will be arranged. You are encouraged to bring a scientific calculator to the exams, but the calculator cannot be a part of a cell phone, iPad, etc. (i.e., it must be ONLY a calculator).

# Grading Scheme:

A letter grade will be assigned based on performance in the course according to the following scale (refer to the [Undergraduate Catalog](https://catalog.wcupa.edu/undergraduate/academic-policies-procedures/grading-information/) for a description of NG (No Grade), W, Z, and other grades):

|  |  |  |  |
| --- | --- | --- | --- |
| **Grade** | **Quality Points** | **Percentage Equivalents** | **Interpretation** |
| A | 4.00 | 93-100 | Excellent |
| A- | 3.67 | 90-92 |  |
| B+ | 3.33 | 87-89 | Superior |
| B | 3.00 | 83-86 |  |
| B- | 2.67 | 80-82 |  |
| C+ | 2.33 | 77-79 | Average |
| C | 2.00 | 73-76 |  |
| C- | 1.67 | 70-72 |  |
| D+ | 1.33 | 67-69 | Below Average |
| D | 1.00 | 63-66 |  |
| D- | 0.67 | 60-62 |  |
| F | 0 | < 60% | Failure |

# Tentative Course Outline:

The following schedule is subject to change at the discretion of the instructor. Every effort will be made to announce changes in advance, but you as a student are responsible for changes.

|  |  |  |  |
| --- | --- | --- | --- |
| **Week** | **Dates** | **Topics** | **Textbook Sections** |
| **1** | 1/25 & 1/27 | Particle Kinematics: Rectilinear Motion  Particle Kinematics: Curvilinear Motion | 12.1 – 12.3  12.4 – 12.7 |
| **2** | 2/1 & 2/3 | Particle Kinematics: Motion of Two Particles  Particle Kinetics: Newton’s 2nd Law, Equations of Motion | 12.9 – 12.10  13.1 – 13.3 |
| **3** | 2/8 & 2/10 | Particle Kinetics: Rectangular Coordinates; Normal & Tangential Coordinates  Particle Kinetics: Work, Energy | 13.4 – 13.5  14.1 – 14.2 |
| **4** | 2/15 & 2/17 | Particle Kinetics: Work, Energy | 14.3 – 14.6 |
| **5** | 2/22 & 2/24 | Particle Kinetics: Linear Impulse, Linear Momentum, Impact | 15.1 – 15.3 |
| **6** | 3/1 & 3/3 | Particle Kinetics: Impact, Angular Impulse, Angular Momentum | 15.4 – 15.10 |
| ***7*** | *3/8 & 3/10* | *Particle Dynamics Review/Overflow; Exam I* | *N/A* |
| **8** | **N/A** | **No Classes (Spring Break)** | **N/A** |
| **9** | 3/22 & 3/24 | Rigid Body Kinematics: Planar Motion (translation, rotation about fixed axis) | 16.1 – 16.4 |
| **10** | 3/29 & 3/31 | Rigid Body Kinematics: Planar Motion (relative motion analysis) | 16.5 – 16.7 |
| **11** | 4/5 & 4/7 | Rigid Body Kinetics: Equations of Motion (translation) | 17.1 – 17.3 |
| **12** | 4/12 & 4/14 | Rigid Body Kinetics: Equations of Motion (rotation about a fixed axis, general motion)  Rigid Body Kinetics: Work, Energy | 17.4 – 17.5  18.1 – 18.4 |
| **13** | 4/19 & 4/21 | Rigid Body Kinetics: Conservation of Energy  Rigid Body Kinetics: Impulse and Momentum | 18.5  19.1 – 19.2 |
| **14** | 4/26 & 4/28 | Rigid Body Kinetics: Conservation of Momentum  Rigid Body Kinematics: 3D  Rigid Body Kinetics: 3D | 19.3  20.1, 20.3  21.1 – 21.3 |
| ***15*** | *5/3 & 5/5* | *Rigid Body Dynamics Review/Overflow; Exam II* | *N/A* |
| **16** | **5/10** | **Final Exam 8:00** | **N/A** |

# Bibliography (Additional resources that may be of interest):

* F.P. Beer, et al., *Vector Mechanics for Engineers: Dynamics*, 12th Ed., McGraw-Hill, 2019
* J. R. Taylor, *Classical Mechanics*, University Science Books, 2005
* J.L. Meriam,  L. G. Kraige, J.N. Bolton, *Engineering Mechanics*, 8th Ed., Wiley, 2015

# Statements Common to All WCU Undergraduate Syllabi:

## Academic & Personal Integrity

It is the responsibility of each student to adhere to the university’s standards for academic integrity. Violations of academic integrity include any act that violates the rights of another student in academic work, that involves misrepresentation of your own work, or that disrupts the instruction of the course. Other violations include (but are not limited to): cheating on assignments or examinations; plagiarizing, which means copying any part of another’s work and/or using ideas of another and presenting them as one’s own without giving proper credit to the source; selling, purchasing, or exchanging of term papers; falsifying of information; and using your own work from one class to fulfill the assignment for another class without significant modification. Proof of academic misconduct can result in the automatic failure and removal from this course. For questions regarding Academic Integrity, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to the Department Undergraduate Handbook, the Undergraduate Catalog, the Ram’s Eye View, and the [University website](http://www.wcupa.edu).

## Excused Absences Policy

Students are advised to carefully read and comply with the excused absences policy, including absences for university-sanctioned events, contained in the WCU Undergraduate Catalog. In particular, please note that the “responsibility for meeting academic requirements rests with the student,” that this policy does not excuse students from completing required academic work, and that professors can require a “fair alternative” to attendance on those days that students must be absent from class in order to participate in a University-Sanctioned Event.

## Students With Disabilities

If you have a disability that requires accommodations under the Americans with Disabilities Act (ADA), please present your letter of accommodations and meet with me as soon as possible so that I can support your success in an informed manner. Accommodations cannot be granted retroactively. If you would like to know more about [West Chester University’s Services for Students with Disabilities (OSSD)](https://www.wcupa.edu/universityCollege/ossd/), please visit them at 223 Lawrence Center. Their phone number is 610-436-2564, their fax number is 610-436-2600, their email address is [ossd@wcupa.edu](mailto:ossd@wcupa.edu). In an effort to assist students who either receive or may believe they are entitled to receive accommodations under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973, the University has appointed a student advocate to be a contact for students who have questions regarding the provision of their accommodations or their right to accommodations. The advocate will assist any student who may have questions regarding these rights. The Director for Equity and Compliance/Title IX Coordinator has been designated in this role. Students who need assistance with their rights to accommodations should contact them at 610-436-2433.

## Inclusive Learning Environment and Anti-Racist Statement

Diversity, equity, and inclusion are central to West Chester University’s mission as reflected in our [Mission Statement](https://protect-us.mimecast.com/s/Kh8QCrk6x5SDqM24CQRU_b?domain=wcupa.edu),[Values Statement](https://protect-us.mimecast.com/s/XD1FCv2kB5Ty91Arswntb5?domain=wcupa.edu),[Vision Statement](https://protect-us.mimecast.com/s/XD1FCv2kB5Ty91Arswntb5?domain=wcupa.edu) and[Strategic Plan: Pathways to Student Success](https://protect-us.mimecast.com/s/ovVXCwplD5TRj6yghld0bL?domain=wcupa.edu). We disavow racism and all actions that silence, threaten, or degrade historically marginalized groups in the U.S. We acknowledge that all members of this learning community may experience harm stemming from forms of oppression including but not limited to classism, ableism, heterosexism, sexism, Islamophobia, anti-Semitism, and xenophobia, and recognize that these forms of oppression are compounded by racism. Our core commitment as an institution of higher education shapes our expectation for behavior within this learning community, which represents diverse individual beliefs, backgrounds, and experiences. Courteous and respectful behavior, interactions, and responses are expected from all members of the University. We must work together to make this a safe and productive learning environment for everyone. Part of this work is recognizing how race and other aspects of who we are shape our beliefs and our experiences as individuals. It is not enough to condemn acts of racism. For real, sustainable change, we must stand together as a diverse coalition against racism and oppression of any form, anywhere, at any time. Resources for education and action are available through WCU’s [Office for Diversity, Equity, and Inclusion](https://www.wcupa.edu/_admin/diversityEquityInclusion/changeBeginsHere.aspx) (ODEI), DEI committees within departments or colleges, the student [ombudsperson](https://www.wcupa.edu/_services/STU/studentOmbuds/), and centers on campus committed to doing this work (e.g., [Dowdy Multicultural Center](https://www.wcupa.edu/_services/multicultural/), [Center for Women and Gender Equity](https://www.wcupa.edu/_services/stu.wce/), and the [Center for Trans and Queer Advocacy](https://www.wcupa.edu/_services/transAndQueer/)). Guidance on how to report incidents of discrimination and harassment is available at the University’s [Office of Diversity, Equity and Inclusion](https://www.wcupa.edu/_admin/diversityEquityInclusion/).

## Reporting Incidents of Sexual Violence

West Chester University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to comply with the requirements of Title IX of the Education Amendments of 1972 and the University’s commitment to offering supportive measures in accordance with the new regulations issued under Title IX, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. **Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred to the person designated in the University Protection of Minors Policy.** [Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence can be found here](https://www.wcupa.edu/_admin/diversityEquityInclusion/sexualMisconduct/default.aspx).

## Emergency Preparedness

All students are encouraged to sign up for the University’s free [WCU ALERT service](http://www.wcupa.edu/wcualert), which delivers official WCU emergency text messages directly to your cell phone. To report an emergency, call the Department of Public Safety at 610-436-3311.

## Electronic Mail Policy

It is expected that faculty, staff, and students activate and maintain regular access to University provided e-mail accounts. Official university communications, including those from your instructor, will be sent through your university e-mail account. You are responsible for accessing that mail to be sure to obtain official University communications. Failure to access will not exempt individuals from the responsibilities associated with this course.