PURDUE UNIVERSITY | College of Engineering

Engineering Faculty Document
No.: 65-25
March 26, 2025

TO: The Engineering Faculty

FROM: The Faculty of the Weldon School of Biomedical Engineering

RE: New 500-level course – BME 53800: Wearables in Healthcare

The Faculty of the Weldon School of Biomedical Engineering has approved the following new 500-level course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

FROM:

BME 59500: Wearable Sensors in Healthcare

Offered Spring Semester
3 credit Lecture
No prerequisites

This course has been offered three times previously as a 3-credit hour BME 59500 course. It has been very well received, growing from 22 students in the first offering to 66 students in the second, and 74 in the third. Average course evaluations have always been above a 4.

TO:

BME 53800: Wearables in Healthcare

Offered Spring Semester
3 credit Lecture
Prerequisite:
GR student attribute
OR
BME 23101

Course description:

Concise Description: This experiential course explores the physiological signals captured by wearable sensors and their potential to address gaps in health care, research, and personal wellness. Students will use their own state-of-the-art wearable device to collect and analyze personal data, gaining hands-on experience through interactive lectures, labs, and assignments. The course emphasizes both the promise and limitations of current wearable technologies, inspiring future innovation in medical, military, industrial, and personal applications.

Expanded Description: This experiential learning course is designed to teach upper-level undergraduate, MS, and PhD students about the origin and meaning of physiological signals collected by wearable sensors (e.g., smart watches and smart patches) and to develop the skills needed to process and analyze these data streams. An important emphasis of the course is in framing the value and challenges of wearable sensors and their data in addressing current gaps in health maintenance, health care, and health research. Through the knowledge and experience gained, we aim to inspire students to identify opportunities for future innovations in medical (mental and physical health), military, industrial, personal, and social applications. Students are given their own state-of-the-art wearable sensor (Corsano 287-2B) at the start of the course that they can use as a personal source of data for analysis throughout the semester. Throughout the 16-week course, students can expect to learn about physiology (including their own physiology) through interactive lectures, directed reading, a state-of-the-art virtual cadaver lab, a series of experiential learning labs, individual homework assignments, and group assignments.

Students enrolled in this course will learn to appreciate the complex, interacting physiological systems that define each person's unique responses to all aspects of their daily lives. Students will also learn about the use of wearable sensors for personal health tracking (e.g., activity/exercise, sleep) and explore their potential role in personal health management. Students will learn about the various types of sensors on their smartwatch, the signals that they transduce, the information that they provide to us or a physician, and perhaps most importantly, the gaps in information and technology that are preventing more widespread use and adoption of modern wearable sensors.

RATIONALE:

This unique course bridges core concepts in physiology, biomedical signal processing, and real-world health applications through hands-on experience with cutting-edge wearable sensor technology. As the healthcare industry increasingly moves toward personalized, data-driven solutions, this course offers students the opportunity to work directly with physiological data from their own bodies, deepening their understanding of human systems and enhancing their skills in data analysis, sensor technology, and translational biomedical innovation. It prepares students to critically evaluate and contribute to the development of next-generation wearable devices and digital health solutions, making it highly relevant for careers in biomedical research, healthcare technology, and medical device development.

Signed by:
Kevin John Otto
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Kevin Otto, Ph.D.
Dane A. Miller Head and Professor
Weldon School of Biomedical Engineering

Link to Curriculog entry: New Proposal 4/9/2025 1:23 pm | Curriculum

Spring 2025 Syllabus*
BME 53800: Wearable Sensors in Healthcare

*Subject to Change

Spring 2025, 3 credits, CRN 16176

Class Meeting Dates and Times:

- Every Mon. | Wed. | Fri. from 10:30 – 11:20 AM Eastern Time
  - Format: In person (no virtual option)
  - Location: MJIS 1097
- Brightspace: https://purdue.brightspace.com/d2l/login

Instructors:

Matthew Ward
(he/him/his)
MJIS 2027
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Steven Steinhubl
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Office Hours (TBD):

- **Office hours with TAs**
  - **When**: Mondays, 3:00 – 5:00 PM ET
  - **Where**: MJIS 1001
- **Office hours with Dr. Ward**
  - **When**: Wednesdays 11:30 AM – 12:20 PM ET
  - **Where**: MJIS 2027
- **Office Hours with Dr. Steinhubl**
  - **When:** Mondays 11:30 AM – 12:20 PM ET
  - **Where:** MJIS 2100
- **Other options**
  - One-on-one office hours available by appointment at any time (via Purdue email)

Email Policy: We will be available via Purdue email on weekdays and most weekends. Please allow up to 48 hours for a response over weekends and up to 24 hours for a response on weekdays. When emailing us, please address both instructors and place the course name and the topic in the subject line of the email (e.g., "Spring 2025 Wearable Sensors Course – Homework question"). If the question is urgent/time sensitive, please insert "[URGENT]" at the start of your subject line (e.g., "[URGENT] Spring 2025 Wearable Sensors Course – Homework question"). This email format will help us to locate and respond to your email appropriately.

COURSE DESCRIPTION

This experiential learning course is designed to teach students about the origin and meaning of physiological signals generated by wearable sensors (e.g., wrist-based sensors), the skills needed to process and analyze these data streams, and their potential value in healthcare. An important emphasis of the course will be in framing the value and challenges of wearable sensors and their data in addressing current gaps in health maintenance, health care and health research. Through the knowledge and experience gained, we hope to inspire students to identify opportunities for future innovations in medical

(mental and physical health), military, industrial, personal, and social applications. Students will be given their own state-of-the-art wearable sensor (Corsano 287-2B) at the start of the course and will learn about their physiology and its unique responses to their routine behaviors through interactive lectures, directed reading, homework assignments, a state-of-the-art virtual cadaver lab, a series of experiential learning labs, and group assignments.

Students enrolled in this course will learn how physiological systems interact in health and disease and how they can vary throughout the day and day-to-day and with ordinary daily activities. Students will also learn about the use of wearable sensors for personal health tracking (e.g., activity/exercise, sleep) and explore their potential role in personal health management. Students will learn about the various types of sensors on their Corsano device, the signals that they transduce, the information they can provide to us or healthcare providers. The gaps in information and technology that are barriers to more widespread use and adoption of wearable sensors into systems of care.

Course Objectives

- Identify key problems to be solved in medical care and health maintenance and understand how current and future wearable sensor technologies might address them.
- Understand, through first-hand experience, the challenges and capabilities of utilizing wearable sensor data to understand individualized physiologic changes in routine daily activities.
- Learn data analytic skills necessary to accurately translate raw wearable sensor data into meaningful physiologic measures
- Appreciate the value of individual biometrics detectable via wearable sensors in addressing a myriad of health concerns.
- Demonstrate an ability to apply individual biometrics to a specific health need(s)
- Understand the need and barriers to meaningfully addressing diversity and equity in all aspects of utilization of wearable sensors in health care.
- Appreciate the challenges of maintaining privacy of health data and preserving security in all aspects of data handling.
- Address the challenges of precision communication in providing health-related information back to users of wearable sensors.

Throughout the semester (which starts at 10:30 AM ET on Monday, 1/13/25; MJIS 1097), you will learn about:

1. Consumer and medical grade wearables through first-hand experience of wearing a provided medical-grade, multivariate wrist wearable and analyzing that data.
2. Signal acquisition, processing, feature extraction and data interpretation
3. Special considerations:
    a. Age (e.g., prenatal, neonatal, pediatrics, adults, geriatrics, end-of-life)
    b. Gender
    c. Race/ethnicity
    d. Socioeconomic class
    e. Multi-omics
4. Applications:
    a. Understanding your “normal”
    b. Stress physiology
    c. Sports/active physiology
    d. Sleep physiology

   e. Illness physiology
   f. Arrhythmia detection
5. Clinical considerations
   a. Regulatory system
   b. Health system needs versus the needs of the wearer
   c. Inequity considerations - Addressing socioeconomic and racial disparities
   d. Privacy and security (e.g., re-identification of individuals from wearable-derived data)
   e. Return of information
6. Consumer considerations
   a. Usability
   b. Balancing consumer needs versus sensor/data quality needs

Through individual/group-based assignments and labs, you will apply these skills and learn how to:

1. Acquire, pre-process/condition and analyze changes in:
   a. heart rate and heart rate variability (using primarily a wrist-based photoplethysmography but also spot-checked single lead electrocardiogram)
   b. respiration rate (from the autonomic nervous system-mediated, beat-to-beat changes in heart rate known as respiratory sinus arrythmia, from transthoracic impedance measurements, or from air flow/breath temperature)
   c. Blood oxygen saturation
   d. Skin temperature
   e. Blood pressure
   f. Galvanic skin resistance / electrodermal activity
2. Acquire baseline data over different timescales and measure changes in physiologic data over different timescales and in response to different types of activities and stressors
   a. Students will learn about diurnal rhythms and the importance of considering the time-of-day in their analysis/decision-making processes
   b. Students will learn about the impact of physical, psychological, and psychosocial stressors on autonomic physiology and behavior changes over acute and chronic timescales
   c. Students will learn about the impact of activity on general health and well-being and on signal fidelity (e.g., motion artifact)
3. Classify and predict:
   a. various cardiac arrythmias (using pre-existing datasets)
   b. onset of illness (viral or bacterial)
   c. mental stress (normal and adverse impact of mental stressors like a sudden loss of status, life changing event, etc., on peripheral physiology/health) and how to differentiate it from physical stress (e.g., illness from injury or infection)
4. Identify potential solutions to improve adoption and use of wearable-sensors in clinical care
5. Learn about the effects of poor signal fidelity, low temporal resolution, lossy datasets, and sensor placement on the utility of the data for medical decision-making purposes

BME 53800: Wearable Sensors in Healthcare*

*Subject to Change

Lecture Schedule:

Class Date	Lecture Topic(s)	Assignment(s)*
Week 1: 13-19 January 2025		
1/13	First day of class • Course overview and expectations • Introduction to wearables in healthcare • General Q&A	**Homework Assignment:** 1) Complete pre-course knowledge assessment via Qualtrics (https://purdue.ca1.qualtrics.com/jfe/form/SV_0og7E5wgLPQj2ya) **Complete by**: 1/15
1/15	The need for health care disruption and potential role of wearable sensors.	**Suggested Readings:** 1. Key Issues as Wearable Digital Health Technologies Enter Clinical Care. https://www.nejm.org/doi/10.1056/NEJMra2307160 2. Disrupting the power balance between doctors and patients in the digital era. https://www.thelancet.com/journals/landig/article/PIIS2589-7500(21)00004-2/fulltext
1/17	A brief primer on cardiac anatomy & physiology & the cardiovascular brain.	**Suggested Reading:** 1) Mohanta SK, et al. Cardiovascular Brain Circuits. Circulation Research. 2023 May 26;132(11):1546-65 https://www.ahajournals.org/doi/pdf/10.1161/CIRCRESAHA.123.322791 2) Pertinent Sections of Chapters 3 & 4 in *Survival Guide for Anatomy & Physiology*, 2nd Edition.
Week 2: 20-26 January 2025		

1/20	*No class (Martin Luther King Jr. Day)*	Complete suggested reading assigned on Friday, 1/17
1/22	• Review of Course Pre-Survey Results • Distribution of Corsano wearable device to students • Formation of teams	Set up Corsano 287-2B wearable
1/24	Getting to know your wearable in-class lab • Finish setting up Corsano • Where is your data going and who else has access? Learn how to access Corsano Dashboard and your data	**Required Reading:** 1) Corsano vitals specifications (May 2022) https://corsano.com/wp-content/uploads/2022/05/Corsano-CardioWatch-Vital-Parameters.pdf 2) CardioWatch Manual (August 2023) https://corsano.com/knowledge-base/ifu-cardiowatch-287-2b/ **Required Corsano setup**: Please set up your Corsano before class 1/24 (i.e., install the mobile app and register your device on your phone and in the Corsano Study Portal). **Complete by**: 1/24
Week 3: 27 January – February 2, 2025		
1/27	The anatomical & physiological determinants of data sources from your wearable sensor: Part 1	**Suggested Reading:** 1) **Chapter 1-2** from Why Zebras Don't Get Ulcers* 2) **Appendix 1: Neuroscience 101** and **Appendix 2: The Basics of Endocrinology** from Behave** *Robert M. Sapolsky. Why Zebras Don't Get Ulcers: The Acclaimed Guide to Stress, Stress-Related Diseases, and Coping (3rd Edition). *Holt Paperbacks*, 2004. **Sapolsky, Robert M., Behave: The Biology of Humans at Our Best and Worst. New York, New York, *Penguin Press*, 2017.

1/29	The anatomical & physiological determinants of data sources from your wearable sensor: Part 2: Anatomy and physiology of the autonomic nervous system	**Required Reading:** L. K. McCorry, "TEACHERS' TOPICS: Physiology of the Autonomic Nervous System," *American Journal of Pharmaceutical Education,* vol. 71, no. 4, pp. 1-11, 2007. URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1959222/pdf/ajpe78.pdf **Suggested Reading:** 1) **Chapter 3** from Why Zebras Don't Get Ulcers* 2) **Chapter 4** from Why Zebras Don't Get Ulcers *Robert M. Sapolsky. Why Zebras Don't Get Ulcers: The Acclaimed Guide to Stress, Stress-Related Diseases, and Coping (3rd Edition). *Holt Paperbacks*, 2004. 3) L. K. McCorry, "TEACHERS' TOPICS: Physiology of the Autonomic Nervous System," *American Journal of Pharmaceutical Education,* vol. 71, no. 4, pp. 1-11, 2007. URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1959222/pdf/ajpe78.pdf
1/31	**ECG Block:** What is the value of a 30-second, single-lead ECG? • What is the physiologic basis for an ECG? • What can you diagnosis with a single lead ECG, and what can't you. • What is the role of AI in expanding the value of an ECG	**Homework Assignment:** 1) Teams of 7 to schedule a 90-min block of time (5 available dates with 2 teams per date) with your TAs or Instructors to enter the Virtual Reality (VR) Cadaver Lab. There, you will complete a custom dissection to explore the anatomy of the cardiovascular system and identify the cranial nerves. **Schedule by**: Friday, 2/7, 5 PM ET (Use sign up sheet pinned under the

		Announcements section in Brightspace) – Complete before end of February 2025 **Suggested Reading:** 1. Clinical Validation of 5 Direct-to-Consumer Wearable Smart Devices to Detect Atrial Fibrillation. *JACC Clin EP* 2023;*https://doi.org/10.1016/j.jacep.2022.09.011* 2) Prospective evaluation of smartwatch-enabled detection of left ventricular dysfunction. *Nature medicine 2022; https://doi.org/10.1038/s41591-022-02053-1*
Week 4: 3 - 9 February 2025		
2/3	ECG - A practical guide to biomedical signal processing (Part 1) 1) Selecting an appropriate sample rate for different types of physiological signals 2) Practical guide to signal conditioning (baseline adjustment, filtering, phase preservation and alignment)	**Homework Assignment 1**: Write a script that can load raw EKG data, apply an appropriate signal conditioning and filtering scheme, and plot the results* *Full assignment description to be posted to Brightspace **Highly Recommended Reading:** 1) The Belmont Report. Available from: https://www.hhs.gov/ohrp/regulations-and-policy/belmont-report/read-the-belmont-report/index.html **Bring homework to class on**: 2/5
2/5	ECG - A practical guide to time-series analysis at different time scales, feature selection, extraction, and classification. (Part 2) 1) We will take a more scenic, guided walk through of the MATLAB code today	**Homework Assignment 2**: Building on your previous assignment, write a script/function that identifies R peak indices from pre-conditioned/filtered EKG data, computes RR intervals, and plots RR interval versus time*

	2) We will push further along with the analysis and teach you how to use pre-built MATLAB functions and manual thresholding techniques to extract R peaks from the time series EKG data. 3) We will also assign Homework 2 today, but it will only be due on 2/12 4) The second half of class, we will let you work on your homework assignment from 2/3 so that the TAs and instructors can assist anyone with questions or in need of additional instruction on how to use the code	*Full assignment description to be posted to Brightspace **Complete by**: 2/12
2/7	Group Activity: Create step-by-step instructions for homework 1 and 2 together.	In-class presentation of each team's strategy and instructions.
Week 5: 10 - 16 February 2025		
2/10	**Activity and Sleep Block:** Measures of Activity in Health & Disease: • Why does being active matter, and how much is enough? • How do different devices estimate activity levels and classify types of activity?	**Suggested Reading:** 1) O. L. Charansonney, and J.-P. Després, "Disease prevention—should we target obesity or sedentary lifestyle?," Nature Reviews Cardiology, vol. 7, no. 8, pp. 468-472, 2010. DOI: 10.1038/nrcardio.2010.68 2) B. del Pozo Cruz, M. N. Ahmadi, I.-M. Lee et al., "Prospective Associations of Daily Step Counts and Intensity with Cancer and Cardiovascular Disease Incidence and Mortality and All-Cause Mortality," JAMA Internal Medicine, vol. 182, no. 11, pp. 1139-1148, 2022. DOI:10.1001/jamainternmed.2022.4000
2/12	Objectively measured sleep in health and disease. • What is the "right" amount of sleep for you?	**Suggested Reading**: 1) O. Itani, M. Jike, N. Watanabe *et al.*, "Short sleep duration and health outcomes: a systematic review, meta-analysis, and meta-regression," *Sleep Medicine,* vol.

	• What are the important components of sleep and how good is a wrist sensor at measuring them?	32, pp. 246-256, 2017. DOI: https://doi.org/10.1016/j.sleep.2016.08.006 2) S. A. Rahman, D. Rood, N. Trent *et al.*, "Manipulating sleep duration perception changes cognitive performance – An exploratory analysis," *Journal of Psychosomatic Research,* vol. 132, pp. 109992, 2020. DOI: https://doi.org/10.1016/j.jpsychores.2020.109992
2/14	**Applications Lab 1 (Part 1)**: Learn how to import your Corsano data into MATLAB, how to work with UNIX time, how to plot different data types collected at different rates, how to pre-condition/filter PPG data, how to measure HR from PPG data, and how data quality is impacted by activity level. Signal Processing Lab 1: Accelerometry 1) Applications (e.g., sleep detection, gait analysis, other applications?)	**Homework Assignment 3**: Understanding variation in physiologic data over different time scales* *Full assignment description to be posted to Brightspace **Suggested Reading:** 1) **Chapter 5 & 6** from Why Zebras Don't Get Ulcers* *Robert M. Sapolsky. Why Zebras Don't Get Ulcers: The Acclaimed Guide to Stress, Stress-Related Diseases, and Coping (3rd Edition). *Holt Paperbacks*, 2004. **Complete by**: 2/19
Week 6: 17-23 February 2025		
2/17	**Pulse Rate & Rhythm Block:** Pulse rate and rhythm in health and disease • What is a normal pulse rate and is it the same for everyone? • How can knowing someone's normal pulse rate be used to improve disease detection? • What are the challenges to identifying pulse rhythm abnormalities with a wrist wearable sensor?	**Suggested Reading**: 1) G. Quer, P. Gouda, M. Galarnyk *et al.*, "Inter- and intraindividual variability in daily resting heart rate and its associations with age, sex, sleep, BMI, and time of year: Retrospective, longitudinal cohort study of 92,457 adults," *PLoS ONE,* vol. 15, 2020. DOI:10.1371/journal.pone.0227709

		2) S. A. Lubitz, A. Z. Faranesh, C. Selvaggi *et al.*, "Detection of Atrial Fibrillation in a Large Population Using Wearable Devices: The Fitbit Heart Study," *Circulation,* vol. 146, no. 19, pp. 1415-1424, 2022. DOI: 10.1161/CIRCULATIONAHA.122.060291
2/19	**Applications Lab 1 (Part 2)**: Learn how to import your Corsano data into MATLAB, how to work with UNIX time, how to plot different data types collected at different rates, how to pre-condition/filter PPG data, how to measure HR from PPG data, and how data quality is impacted by activity level.	**Homework Assignment 4:** Preconditioning and feature extraction from PPG data* *Full assignment description to be posted to Brightspace On Friday, 2/21, we will study similarities and differences in the PPG waveforms measured with different wavelengths. A key insight we are after: Is there a way to determine which PPG wavelength is best for me? What factors must we consider? **Complete by**: 2/21
2/21	Photoplethysmography as a source of data & **Signal Processing Lab 2:** Heart rate We will use the tools/code that we have developed to date to study factors that impact PPG signal fidelity when measured with different wavelengths (i.e., colors).	**Suggested Reading:** 1) D. Ray, T. Collins, S. I. Woolley and P. V. S. Ponnapalli, "A Review of Wearable Multi-Wavelength Photoplethysmography," in IEEE *Reviews in Biomedical Engineering*, vol. 16, pp. 136-151, 2023, doi: 10.1109/RBME.2021.3121476. 2) Liang, Y., Elgendi, M., Chen, Z. *et al.* An optimal filter for short photoplethysmogram signals. *Sci Data* **5**, 180076 (2018). https://doi.org/10.1038/sdata.2018.76

Week 7: 24 February – March 2 2025		
2/24	**Respiration Block:** The value of tracking respiratory rate and oxygen saturation in health. • Challenges and opportunities for measuring respiratory rate in health. • Racial biases in measuring oxygen saturation and its consequences.	**Suggested Reading:** 1) Racial bias in pulse oximetry measurement." *New England Journal of Medicine* 383.25 (2020): 2477-2478.
2/26	**Applications Lab 2 (Part 1):** Day versus night-time data quality in pulse and respiratory rate + understanding your normal inter- and intra-individual variability in activity and sleep	**Homework Assignment 5:** Analysis of physiology over timescales ranging from seconds to one week* *Full assignment description to be posted to Brightspace **Complete by**: 3/7
2/28	**Applications Lab 2 (Part 2)**: Day versus night-time data quality in pulse and respiratory rate data. We will work on homework that was assigned on 2/26	**Homework Assignment 6**: Make sure that your Corsano device is setup to measure BioZ, emography, and other stress-related measurements. You will need these data for an upcoming assignment and lab.* *Full assignment description to be posted to Brightspace **Complete by**: 3/3
Week 8: 3 – 9 March 2025		
3/3	**Applications Lab 2 (Part 3)**: Day versus night-time data quality in heart rate We will work on homework that was assigned on 2/26	**Suggested Reading:** 1) **Chapter 8** from Why Zebras Don't Get Ulcers ("Immunity, Stress, and Disease") * 2) **Chapter 9** from Why Zebras Don't Get Ulcers ("Stress and Pain") *Robert M. Sapolsky. Why Zebras Don't Get Ulcers: The Acclaimed

		Guide to Stress, Stress-Related Diseases, and Coping (3rd Edition). *Holt Paperbacks*, 2004.
3/5	**Skin Temperature and Conductance Block:** The value of tracking temperature and electrodermal activity in health. • How (and why) does out temperature control system work? • How can continuously tracking your temperature throughout the day help maintain health? • What, if any, is the role of measure changes in electrodermal activity?	**Suggested Reading:** 1.) The daily, weekly, and seasonal cycles of body temperature analyzed at large scale. *Chronobiology International* 36.12 (2019): 1646-1657. 2.) What does large-scale electrodermal sensing reveal? *bioRxiv 2024; doi: https://doi.org/10.1101/2024.02.22.581472*
3/7	**Signal Processing Lab 3 (Part 1)**: Electrodermal activity and skin temperature • (OPTIONAL) Complete the Perceived Stress Scale – not to be turned in (for your own eyes only) (https://www.das.nh.gov/wellness/docs/percieved%20stress%20scale.pdf) or similar validated survey • Learn how to work with EDA/GSR data • Examine the how your EDA/GSR signals change in response to an acute psychological stress: A mental math task	**Homework Assignment 7**: Analysis of physiologic responses to moderately stressful event* *Full assignment description to be posted to Brightspace **Complete by***: 3/10 before 10:30 AM EST **We will analyze these data in class on 3/10. You will have a 20-point assignment based on these data due after the next in-class lab, so it is important that you complete these tasks before class on 3/1.
Week 9: 10 - 16 March 2025		
3/10	**Signal Processing Lab 3 (Part 2)**: Electrodermal activity and skin temperature • Analyze data from a past event that you identified as moderately stressful • Learn how to compute various metrics from your chosen datasets • Learn how to quantify similarities and differences in trends among different biosignals	**Homework Assignment 8**: Extended analysis and reporting of changes in physiology in response to stressful event* *Full assignment description to be posted to Brightspace **Complete by**: 3/14

	• Explore inter- and intra-individual variability in the physiological response signature to a moderate stressor • (OPTIONAL): Examine the impact of the "diving reflex" (a method of increasing vagally-mediated heart rate variability) on HR, respiration, EDA/GSR and other biosignals	
3/12	The Challenges of Return of Medical Information. Understanding the Power of the Placebo/Nocebo Effect	**Suggested Readings:** 1. Placebo and nocebo effects. *New England Journal of Medicine 382.6 (2020): 554-561.* *https://www.nejm.org/doi/full/10.1056/NEJMra1907805* 2. An evaluation of internal-mammary-artery ligation by a double-blind technic. *New England Journal of Medicine 260.22 (1959): 1115-1118.* *https://www.nejm.org/doi/full/10.1056/NEJM195905282602204*
3/14	Review session for mid-term exam & as-needed assistance with Signal Processing Lab 3 homework.	**Homework Assignment SB2025:** Have a relaxing and enjoyable Spring Break
Week 10: 17 - 23 March 2025		
3/17	*No class (Spring Break)*	
3/19	*No class (Spring Break)*	
3/21	*No class (Spring Break)*	
Week 11: 24 - 30 March 2025		
3/24	**Heart Rate Variability Block:** Heart rate variability (HRV) in health and disease: A valuable tool looking for the right problem(s) it can solve. • How is HRV measured, and do we know the "right" way to measure it?	**Suggested Reading:** 1) Ambulatory and challenge-associated heart rate variability measures predict cardiac responses to real-world acute emotional stress.

	• How is HRV used in health care?	*Biological psychiatry* 67.12 (2010): 1185-1190. 2) Heart rate variability: standards of measurement, physiological interpretation and clinical use. Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology." *Circulation 93.5 (1996): 1043-1065.*
3/26	**Application Lab 3 (Part 1)**: Time Domain Heart Rate Variability Analysis • Learn how to apply common time-domain heart rate variability (HRV) analytics to your data • Understand how to perform a sliding window analysis and how to determine the minimum viable window size and overlap for computing different HRV metrics that analyze HRV over different timescales • Explore natural diurnal variations in various HRV metrics	**Required Reading**: 1) Shaffer F, Ginsberg JP. An Overview of Heart Rate Variability Metrics and Norms. *Front Public Health*. 2017 Sep 28;5:258. doi: 10.3389/fpubh.2017.00258. PMID: 29034226; PMCID: PMC5624990. **Complete by**: 3/28
3/28	**In class Midterm Exam**	
Week 12: 31 March – 6 April 2025		
3/31	**Application Lab 3 (Part 2)**: Spectral Heart Rate Variability Analysis • Learn how to apply common frequency-domain heart rate variability (HRV) analytics to your data • Explore similarities and differences in time and frequency-domain HRV metrics	**Suggested Reading:** 1) **Chapter 10** from Why Zebras Don't Get Ulcers ("Stress and Memory") * 2) **Chapter 11** from Why Zebras Don't Get Ulcers ("Stress and a Good Night's Sleep") *Robert M. Sapolsky. Why Zebras Don't Get Ulcers: The Acclaimed Guide to Stress, Stress-Related

		Diseases, and Coping (3rd Edition). *Holt Paperbacks*, 2004.
4/2	**Continuation of Application Lab 3 (Part 2)**: Spectral Heart Rate Variability Analysis & **Midterm Exam Results Review**	
4/4	**Emotional Stress Block:** Stressors, stress and the stress-response in health and disease: Homeostasis versus allostasis & can we measure it?	**Homework Assignment 9:** Analysis of various emotions and impact on autonomic physiology* *Full assignment description to be posted to Brightspace **Suggested Reading:** 1) Hickey, Blake Anthony, et al. "Smart devices and wearable technologies to detect and monitor mental health conditions and stress: A systematic review." *Sensors* 21.10 (2021): 3461 **Complete by**: 4/7*
Week 13: 7 - 13 April 2025		
4/7	**Applications Lab 4 (Part 1)**: Identify physiologic changes associated with unexpected acute psychological stressors • Explore methods to classify/rate relative differences in the type, intensity, and duration of different psychological stressors. Learn and apply ensemble averaging techniques to algorithmically identify specific physiologic activity signatures in long data streams	**Homework Assignment 10**: Provide a summary report that describes your findings from the homework 9 assigned on 4/4 and the analysis performed during Applications Lab 4 (Parts 1 and 2).* *Full assignment description to be posted to Brightspace **Complete by**: **4/21 (due before 10:30 AM ET)**

4/9	**Applications Lab 4 (Part 2)**: Identify physiologic changes associated with unexpected acute stressors • As a class, discuss whether basic feature detection and classification algorithms can (in principle or in practice) accurately identify physiological responses to stressors. Can these methods in their current form distinguish between different types of stressors (e.g., psychosocial, physical, environmental, etc.)? • As a class, discuss when, where, why, and with whom stress monitoring/detection algorithms may or may not be helpful. Can such a tool ever work as a one-size-fits-all solution to the general population or will effective stress monitoring/management devices require an individualized approach?	**Complete homework 10 assigned on 4/4 (due 4/21, before 10:30 AM ET)**
4/11	Blood pressure in health and its measurement via wearables.	**Suggested Reading:** 1. Evaluation of a novel cuffless photoplethysmography-based wristband for measuring blood pressure according to the regulatory standards, *European Heart Journal - Digital Health, 2024;, ztae006, https://doi.org/10.1093/ehjdh/ztae006* 2. Quantifying Blood Pressure Visit-to-Visit Variability in the Real-World Setting: A Retrospective Cohort Study. *Circulation: Cardiovascular Quality and Outcomes. 2023 Mar 8:e009258. https://www.ahajournals.org/doi/abs/10.1161/CIRCOUTCOMES.122.009258*
Week 14: 14 - 20 April 2025		

4/14	The role of Large Language Models in wearables, healthcare and in education	**Suggested Reading:** 1. The benefits, risks and bounds of personalizing the alignment of large language models to individuals.*Nature Medicine Intelligence 2024; https://doi.org/10.1038/s42256-024-00820-y* 2. Results and implications for generative AI in a large introductory biomedical and health informatics course. *Npj Dig Med 2024; https://doi.org/10.1038/s41746-024-01251-0*
4/16	Overview of plans for the 2024 Karaoke Lab! We will review plans for the Karaoke Lab, to be held on Friday, x/xx, from 10:30 AM to 12 PM ET. We will also use the remaining time for a final in-class homework help session.	
4/18	**Guest Speaker -**Milton Aguirre, PhD Assistant Professor, Purdue Polytech "User-Centric Design of Wearable Tech"	
Week 15: 21 - 27 April 2025		
4/21	**Guest Speaker** – Natalia Rodriguez, PhD. Associate Professor, Dept Public Health, Purdue "Techquity – Health Technologies for Health Equity"	
4/23	In-Class Final Assignment Code Development Help Session	**Homework Assignment**: Final Mini-Project Part 2 Essays *See Brightspace for assignment details* **Due**: Friday, 5/2

4/25	**Application Lab 5**: Re-identification of data from biometrics like the ECG waveform, gait analysis, etc.	**Suggested Reading:** 1) **Chapter 12** from Why Zebras Don't Get Ulcers ("Aging and Death") * 2) **Chapter 13** from Why Zebras Don't Get Ulcers ("Why is Psychological Stress Stressful?") *Robert M. Sapolsky. Why Zebras Don't Get Ulcers: The Acclaimed Guide to Stress, Stress-Related Diseases, and Coping (3rd Edition). *Holt Paperbacks*, 2004.
Week 16 (Quiet Week): 28 April – 4 May 2025		
4/28	"Regulatory hurdles – Digital Health and AI" **Guest Speaker** - Aaron Lottes , PhD Professor of Engineering Practice, BME	
4/30	Special Guest Lecture: Dr. Hillary Blake, PsyD: Vagal Resonance Breathing	**Suggested Readings:** 1. Goodday, Sarah M et al. *Disrupting the power balance between doctors and patients in the digital era*. The Lancet Digital Health, Volume 3, Issue 3, e142 - e143 https://www.thelancet.com/journals/landig/article/PIIS2589-7500(21)00004-2/fulltext 2. Rodriguez JA, Shachar C, Bates DW. *Digital inclusion as health care—supporting health care equity with digital-infrastructure initiatives.* New England Journal of Medicine. 2022 Mar 24;386(12):1101-3. https://www.nejm.org/doi/full/10.1056/NEJMp2115646

		3. **Chapter 18** from Why Zebras Don't Get Ulcers ("Managing Stress") *Robert M. Sapolsky. Why Zebras Don't Get Ulcers: The Acclaimed Guide to Stress, Stress-Related Diseases, and Coping (3rd Edition). *Holt Paperbacks*, 2004.
5/2	**Karaoke Lab 2025** -Please plan to meet at Fowler Hall for class today! End of Semester Discussion and Course Survey	**Optional BONUS Homework (Up to 10 BONUS points):** Analyze your data using scripts you have developed and turn it in along with your stress visual analog scale and interpretations. **Due**: Monday, 5/5 *Precise details forthcoming
Finals Week (Week 17): 5 - 10 May 2025 **No Final Exam. Have a great summer!**		
5/5	No class – final exam week	
5/7	No class – final exam week	
5/9	No class – final exam week	

Learning Resources, Technology, and Texts*

- Suggested Texts:
  - Robert M. Sapolsky. Why Zebras Don't Get Ulcers: The Acclaimed Guide to Stress, Stress-Related Diseases, and Coping (3rd Edition). *Holt Paperbacks*, 2004. ISBN #: 978-0-805-07369-0.
  - Kevin T Patton. Survival Guide for Anatomy & Physiology (2nd Edition). *Elsevier Mosby*, 2014. ISBN#9780323112802
- Additional Readings: Journal articles and other publications will be assigned as reading during the course.
- Software/Web Resources: MS Office, Brightspace, MATLAB r2024 or newer (with signal processing toolbox)

- Brightspace: You can access the course materials and discussion boards via Brightspace. It is strongly suggested that you explore and become familiar not only with the site navigation, but with content and resources available for this course. See the Help tab for resources.

Learning Outcomes*

By the end of this course, students will be able to:

- Understand the opportunities and challenges of using wearable sensors within the healthcare system through directed reading and experiential learning assignments
- Dictate the key ethical and professional guidelines when working with healthcare data through directed reading, guest lectures, and self reflection
- Quantitatively process and interpret a variety of physiologic signals and derived data streams across various physiologic and clinically-relevant timescales, especially pertaining to cardiovascular and thermoregulatory systems
- Cite – from traditional lecture-based learning, directed reading, and knowledge gained from experience working with one's own data – how the brain and autonomic nervous system governs involuntary organ and body functions at the tissue, organ, and system level to maintain homeostasis across different allostatic loads, and how DHT-derived data streams can be processed and analyzed to identify patterns of activity indicative of normal stress physiology, abnormal stress physiology, infection, or disease
- Comfortably apply advanced signal processing and statistical methods to process noisy and discontinuous DHT-derived data streams to produce meaningful estimates of physiologic activity that account for uncertainty in the measurements through analysis of their own physiologic data streams throughout the semester, assessed through in-class labs, team-based coding competitions, and homework assignments
- Communicate effectively between mathematical, engineering, biological, and medical disciplines, including with subject matter experts, through knowledge gained from the unique mix of lectures and labs taught by instructors with medical and engineering expertise

Course Requirements and Graded Outcomes*

The breakdown of the points for this class are as follows:

- In-class labs 40%
- Homework assignments 20%
- Midterm exam 10%
- Final project 20%
- Participation in discussions/group work 10%

Individual students will have very different backgrounds coming into this course, and the instructors will take this into account by evaluating students based on their demonstrated effort, participation, and progress during the course. Additionally, the diverse backgrounds of the students in this course presents a strong opportunity to learn not only from the instructor and the seminar speakers, but from fellow students with differing learned experiences, technical backgrounds, and perspectives.

In-class Labs 40%

We have 4 Signal Processing labs and 8 Application labs scheduled over the course of the semester. Points may be assigned differently to different labs based on the complexity of the respective lab(s).

However, labs will account for no more than 40% of your final grade. Lab assignment descriptions and grading criteria will be posted to Brightspace on or before the class period preceding the day of the lab.

Homework Assignments 20%
We will assign various types of homework throughout the semester (coding, mathematics, data visualization, reports, etc.). Up to 10 assignments should be expected. Homework may be periodically assigned as a team-based effort, in which all students on the team will share the grade on the team assignment. Consulting with your peers on any homework is highly encouraged. However, each person must write their own code (unless otherwise specified) based on a logical understanding of the task and should avoid copying and pasting someone else's original code. The goal here is not to develop the most efficient and elegant piece of code, but to get you comfortable with using basic programming tools, logic, and intuition to derive new and medically useful information from the complex physiological and behavioral datasets we collect. I expect that you provide adequate comments in your code for me to understand your thought process.

Midterm Exam 10%
We will have one in-class midterm exam (scheduled for Fri., 4/28/25). This exam will count for 10% of your final grade. It will cover all course content provided through Friday, 4/21/25.

Final Project 20%
Precise breakdown to be posted by mid-semester.

Participation 10%
Participation is key to your success in this course.

Instructor Evaluations 0%
Students are strongly encouraged to evaluate their instructors mid-semester and at the end of the semester. These constructive evaluations and other student feedback are essential for the instructors to improve their teaching, to improve the structure/content of the course, and to improve the overall quality of education in Biomedical Engineering at Purdue.

- End-of-semester evaluation*: To be completed the first week of May 2025
    - *Survey link will be posted at the end of the semester*

Formatting Guidelines for Assignments
All assignments and reports, including assignment descriptions, templates and grading criteria, will be posted to Brightspace no later than the day before they are assigned in class. All written assignments and reports must adhere to the following guidelines:

- 12 pt. Times New Roman or Arial font
- 1" margins
- Single spaced
- Works cited in IEEE numbered format, including a valid Digital Object Identifier (DOI). An example is provided below:
    - [1] J. Pan and W. J. Tompkins, "A Real-Time QRS Detection Algorithm," in *IEEE Transactions on Biomedical Engineering*, vol. BME-32, no. 3, pp. 230-236, March 1985, doi: 10.1109/TBME.1985.325532.

- If the document exceeds one page, include page numbers in the footer (aligned to the right side of the document using 10 pt. Times New Roman or Arial font)
- In the header, place the following information (aligned to the right side of the document) using 10 pt. font:
    - Line 1: First Initial. Last Name | DD/MM/YY (*e.g.*, M. Ward | 04/25/24)
    - Line 2: Brief assignment description (*e.g.*, Paper Summary 1: Steinhubl)
- All code must be accompanied with enough annotation for your instructors to understand your logic
    - You may paste your code into your MS Word document or upload the code separately as a .m file (or equivalent if using something other than MATLAB)
    - If you use functions of specialized code from an open-source repository, be sure to cite the source of the code. In these cases, also describe what that portion of the code does using your own words.
    - Always indicate the units of your variables in your code. Unit conversion errors are some of the most common bugs in code that can prevent you from seeing an expected output. I suggest using SI units for all calculations and then converting units to an appropriate scale when plotting.
- All figures (e.g., generated from your code or data analysis) must include a figure number and a descriptive figure caption. Figure captions are placed directly below the figure.
    - Be sure to label all axes with descriptive labels and units of measurement
    - The font should be large enough for us to read

Missed or Late Work
Missed assignments may only be made up when you notify the instructor ahead of time with an explanation and *plan for completion*. These requests will be accepted at the instructor's discretion and may include up to a 50% point penalty. Asking for an extension does not guarantee it will be granted.

Grading Scale
Grades in this course will reflect the sum of your participation and achievement throughout the semester. You will accumulate points as described above, and final grades will be calculated as a percentage of maximum total points and translated into the following letter grades. Percentages will be rounded to the closest integer percentage for the purposes of assigning a letter grade. *You will get a good grade if you critically review all of the assigned articles, show up to class, actively participate in discussions, and follow assignment & final project rubrics.*

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
97 - 100%	93 - 97%	90 - 93%	87 - 90%	83 - 87%	80 - 83%	77 - 80%	73 - 77%	70 - 73%	67 - 70%	63 - 67%	60 - 63%	0 - 60%

GENERAL COURSE GUIDELINES AND POLICIES

Participation
100% participation is expected for this course^{++}. Given that participation is a large component of student success, late arrivals, early departures, lack of attention, or lack of participation will have a significant detrimental effect on your grade.

The student is responsible for informing the instructor of any conflict that can be anticipated that may affect the submission of an assignment or the ability to participate in class discussions. Only the instructor can excuse a student from a course requirement or responsibility. When conflicts can be anticipated, such as for many University-sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency conflict, when advance notification to an instructor is not possible, the student should contact the instructor or the instructor's department (Biomedical Engineering) as soon as it is possible to do so by email (preferred) or through Brightspace. When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor's department (Biomedical Engineering) due to circumstances beyond the student's control, and in cases of bereavement, quarantine, or isolation, the student or the student's representative should contact the Office of the Dean of Students via email or phone at 765-494-1747. Our course Brightspace includes a link on Attendance and Grief Absence policies under the University Policies menu.

[++]*Participation does not require any student to share their personal health data. Students will not be penalized if they do not want to share their personal data. Representative, anonymous data sets are available* ***by request*** *for anyone desiring to not use their own data sets for any reason.*

Academic Code of Conduct

You are expected to behave in a professional and ethical manner in all aspects of this course. *Plagiarism, fabrication, falsification, or any form of cheating will result in a zero for that particular assignment and other potential ramifications, including a report to Office of Dean of Students (ODOS).* Instances of unethical behavior will be reported to the ODOS and will result in a grade reduction of at least one letter grade. If an individual behaves unprofessionally or unethically during the semester, the instructor reserves the right to fail the student. For more information, see Purdue University Student Conduct Code at: https://catalog.purdue.edu/content.php?catoid=13&navoid=16335.

Academic Integrity

Academic integrity is one of the highest values that Purdue University holds. Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty." [Part 5, Section III-B-2-a, University Regulations] Furthermore, the University Senate has stipulated that "the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest." [University Senate Document 72-18, December 15, 1972]

Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information is submitted the greater the opportunity for the university to investigate the concern. More details are available on our course Brightspace under University Policies.

Responsible Use of AI

Unless we specify otherwise for a particular assignment, the use of AI tools in completing homework assignments is expressly prohibited. We will have certain activities that utilize AI. The rules below will apply for those instances only.

1. Original Work: Students should ensure that assignments submitted are original and based on their understanding. An AI tool should not produce work on behalf of the student.
2. Citation: Any content, ideas, or assistance obtained through AI tools must be appropriately cited, similar to any other reference or source. You will need to go and find the relevant citations from the primary literature (journal articles)!
3. Collaboration: If a student collaborates with AI tools, they must specify the nature and extent of this collaboration in their submission. This includes providing details of the prompts used to generate the AI responses.
4. Prohibited Uses: AI should never be used to complete quizzes, exams, or any other assessments unless explicitly permitted by the instructor.
5. Accessibility: All students must have equal access to AI tools. If a particular tool is used in a course, it should be free of cost for all users. Therefore, no paid AI services will be allowed for any work done in this course.
6. Data Privacy: Students must be cautious when sharing personal or sensitive information with AI platforms and should be familiar with the terms of service of any third-party AI tools.

Consequences for Misuse: *Misuse of AI tools in coursework, which includes but is not limited to producing unoriginal work, uncited use of AI-generated content, or unauthorized assistance on assessments, will be considered a breach of academic integrity.* Consequences will follow the Purdue's policies on academic dishonesty as detailed in this syllabus, which may include grade penalties, course failure, or more severe disciplinary actions.

Re-grade Policy

Students have the right to protest any grade throughout the semester. Once an assignment has been graded and returned, students have **1 week** to protest a grade; after this time, grade disputes will not be accepted. In the event that a student feels an assignment has been inappropriately graded, the student must submit a typed document (no longer than one page) indicating the source of the problem and an explanation for the re-grade submission. The original assignment must be returned with the protest explanation. Papers submitted for a re-grade will be completely re-evaluated (i.e., the entire paper will be re-graded, not only the portion under protest), which means that students risk losing additional points for mistakes missed during the first grading process. Please note that all re-grade requests will be evaluated at the end of the term and will only be considered for those students with a borderline grade (e.g., between an A and B).

Nondiscrimination Statement

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life.

Purdue University prohibits discrimination against any member of the University community on the basis of race, religion, color, sex, age, national origin or ancestry, genetic information, marital status, parental status, sexual orientation, gender identity and expression, disability, or status as a veteran. The University will conduct its programs, services and activities consistent with applicable federal, state and

local laws, regulations and orders and in conformance with the procedures and limitations as set forth in Executive Memorandum No. D-1, which provides specific contractual rights and remedies. Any student who believes they have been discriminated against may visit www.purdue.edu/report-hate to submit a complaint to the Office of Institutional Equity. Information may be reported anonymously.

Netiquette*

*Applies to Brightspace and general electronic communication (and online learning if applicable).

Your instructor and fellow students wish to foster a safe online learning environment. All opinions and experiences, no matter how different or controversial they may be perceived, must be respected in the tolerant spirit of academic discourse. You are encouraged to comment, question, or critique an idea, but *you are not to attack an individual*. Our differences, some of which are outlined in the University's nondiscrimination statement above, will add richness to this learning experience. Please consider that sarcasm and humor can be misconstrued in online interactions and generate unintended disruptions. Working as a community of learners, we can build a polite and respectful course ambience. Details on netiquette and other tips to help students communicate in online courses are available on the Learning website. Please read the Netiquette rules for this course:

- Do not dominate any discussion. Encourage and give other students an equal and fair opportunity to join in the discussion.
- Do not use offensive language, present ideas appropriately, and treat others as you would have them treat you (i.e., be nice and be a team player).
- Be cautious in using "Internet language." For example, do not capitalize all letters since this suggests shouting.
- Avoid using vernacular and/or slang language. This could possibly lead to misinterpretation.
- Keep an "open-mind" and be willing to express your perspective.
- This course will require diverse perspectives, create thinking, creative ideas, "out-of-the-box" thinking, and healthy scientific debate.
- Think and edit before you push the "Send" button.
- Do not hesitate to ask peers or instructors for feedback.

Accessibility

Purdue University is committed to making learning experiences accessible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

Purdue University is required to respond to the needs of the students with disabilities as outlined in both the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 through the provision of auxiliary aids and services that allow a student with a disability to fully access and participate in the programs, services, and activities at Purdue University.

If you have a disability that requires special academic accommodation, please make an appointment to speak with the instructor within the first three (3) weeks of the semester in order to discuss any adjustments. It is important that we talk about this at the beginning of the semester. It is the student's responsibility to notify the Disability Resource Center (http://www.purdue.edu/drc) of an impairment/condition that may require accommodations and/or classroom modifications.

Mental Health/Wellness

A number of studies in the recent decade have highlighted the potential "crisis" in mental health among graduate studies. While the percentages of students experiencing depression or other mental health conditions varies by field of study, country, and other factors, the need to address mental health in graduate education – and fight stigmatization of mental health issues – is pressing. While not exhaustive, the following are some resources available to you as students:

- The Community, Assistance and Resources for Engineering Students (CARES) Hub is available to support the well-being of all engineering students. The CARES Hub, located in ARMS 1261 and 1264, is a welcoming, inclusive space for students to study, connect, grab a snack, and relax during the week. CARES also offers wellness activities, educational workshops, peer mentoring, social events, and on-site counseling. If you need help handling stress or working through a problem, schedule time with our CARES Hub therapist, Jennie Beutler, here or drop by ARMS 1251 to speak to Jennie without an appointment during her Walk-In Hours from 1:00 – 2:00 p.m. Monday-Friday. Please visit the CARES Hub webpage to learn more. The CARES staff look forward to connecting with you!
- If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack. Sign in and find information and tools at your fingertips, available to you at any time.
- If you need support and information about options and resources, please contact or see your Graduate Program staff or the Office of the Dean of Students (765-494-1747, M-F, 8 AM-5 PM).
- If you find yourself struggling to find a healthy balance between academics, social life, stress, etc., sign up for free one-on-one virtual or in-person sessions with a Purdue Wellness Coach at RecWell. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect.
- If you are struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Basic Needs Security

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students 8 a.m.-5 p.m. Monday through Friday. Considering the significant disruptions caused by the current global crisis as it related to COVID-19, students may submit requests for emergency assistance from the Critical Needs Fund.

Use of Copyrighted Materials

Online educational environments, like all learning environments, should provide opportunities for students to reflect, explore new ideas, post opinions openly, and have the freedom to change those opinions over time. Students enrolled in and instructors working in online courses are the authors of the works they create in the learning environment. As authors, they own the copyright in their works subject only to the university's right to use those works for educational purposes (Visit Purdue University Copyright Office for policies governing Purdue faculty, staff, and students). Among the materials that may be protected by copyright law are the lectures, notes, and other material presented in class or as part of the course. Always assume the materials presented by an instructor are protected by copyright unless the instructor has stated otherwise. Similar copyrights apply for the seminar speakers who will be guests

this semester. Students may not copy, reproduce or post to any other outlet (e.g., YouTube, Facebook, Twitter, Tik Tok, or other open media sources or websites) any work in which they are not the sole or joint author or have not obtained the permission of the author(s).

Students enrolled in, and authorized visitors to, Purdue University courses are permitted to take notes, which they may use for individual/group study or for other non-commercial purposes reasonably arising from enrollment in the course or the University generally. Notes taken in class are generally considered to be "derivative works" of the instructor's presentations and materials, and they are thus subject to the instructor's copyright in such presentations and materials. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern, for a course without the express written permission of the course instructor. To obtain permission to sell or barter notes, the individual wishing to sell or barter the notes must be registered in the course or must be an approved visitor to the class. Course instructors may choose to grant or not grant such permission at their own discretion and may require a review of the notes prior to their being sold or bartered. If they do grant such permission, they may revoke it at any time, if they so choose.

Emergency Preparation
In the event of a major campus emergency, course requirements are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructor via email. You are expected to read your @purdue.edu email on a frequent basis.

Grief Absence Policy for Students
Purdue University recognizes that a time of bereavement is very difficult for a student. The University therefore provides the following rights to students facing the loss of a family member through the Grief Absence Policy for Students (GAPS). GAPS Policy: Students will be excused for funeral leave and given the opportunity to earn equivalent credit and to demonstrate evidence of meeting the learning outcomes for missing assignments or assessments in the event of the death of a member of the student's family.

Violent Behavior Policy
Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent Behavior impedes such goals. Therefore, Violent Behavior is prohibited in or on any University Facility or while participating in any university activity.

Protect Purdue Pledge
Whenever enforced, all students and instructors are expected to follow the Protect Purdue Pledge, which includes submitting vaccination records or participating in frequent surveillance testing and complying with all Protect Purdue guidance. Non-compliance is a student conduct violation (students) or a violation of employment (instructors).

Any student who has substantial reason to believe that another person is threatening the safety of others by not complying with Protect Purdue protocols is encouraged to report the behavior to and discuss the next steps with their instructor. Students also have the option of reporting the behavior to the Office of the Student Rights and Responsibilities. See also Purdue University Bill of Student Rights and the Violent Behavior Policy under University Resources in Brightspace.

Academic Guidance for Cases of Quarantine or Isolation
Although this course will be delivered in person this semester, quarantine, isolation, or illness can nonetheless affect your progress and ability to engage in this course. If you become quarantined or isolated at any point in time during the semester, in addition to support from the Protect Purdue Health Center, you will also have access to an Academic Case Manager who can provide you academic support during this time. Your Academic Case Manager can be reached at acmq@purdue.edu and will provide you with general guidelines/resources around communicating with your instructors, be available for academic support, and offer suggestions for how to be successful during the "return to normal operations" transition period at Purdue.

Importantly, if you find yourself too sick to progress in the course, notify your academic case manager and notify your instructor via email (preferred) or Brightspace. We will make arrangements based on your particular situation. The Office of the Dean of Students (odos@purdue.edu) is also available to support you should this situation occur.