1. **CE 27000: Introductory Structural Mechanics**

   Class Webpage**:** https://purdue.brightspace.com

2. **Credits & Contact Hours:** 4 credits
   Lectures: MWF: 7:30am - 8:20am, **PHYS-114**, Jan 9, 2023 – Apr 30, 2023.
   Lab Prep: T: 8:00am - 8:50am, **PHYS-112**
   Labs: One 2-hour lab per week for 15 weeks (schedule below)

3. **Instructor:** Dr. Arun Prakash (aprakas@purdue.edu)
   Labs and TAs:

Lab Section	HAMP-G157	TAs	Contact
001	T: 9:30am – 11:20am	Ruipu Ji	ji148@purdue.edu
003	T: 11:30am – 1:20pm	Ruipu Ji	ji148@purdue.edu
016	T: 1:30pm – 3:20pm	Tao Zhang	zhan4116@purdue.edu
008	T: 3:30pm – 5:20pm	Tao Zhang	zhan4116@purdue.edu
015	W: 1:30pm – 3:20pm	Harrison Kuszmaul	hkuszmau@purdue.edu
009	W: 3:30pm – 5:20pm	Harrison Kuszmaul	hkuszmau@purdue.edu
010	R: 9:30am – 11:20am	Trishika Kora	tkora@purdue.edu
011	R: 11:30am – 1:20pm	Trishika Kora	tkora@purdue.edu
013	R: 3:30pm – 5:20pm	Apoorv Raj Kumar	kumar599@purdue.edu
014	F: 3:30pm – 5:20pm	Apoorv Raj Kumar	kumar599@purdue.edu

Office Hours (HAMP-1115): Check updated information on the Course Webpage

Wed	2pm - 4pm	Tao Zhang
Wed	4pm – 6pm	Apoorv Raj Kumar
Thu	2pm - 4pm	Dr. Arun Prakash
Thu	4pm – 6pm	Ruipu Ji
Fri	2pm - 4pm	Trishika Kora
Fri	4pm – 6pm	Harrison Kuszmaul

Or email for an appointment.

4. **Textbook(s):**
   - **Required**: *Mechanics of Materials*, 9th / 10th Edition, Prentice Hall, by **R.C. Hibbeler**.
   - **Suggested**: *Vector Mechanics for Engineers: Statics*, 9th - 14th Edition, McGraw Hill, by **Beer & Johnston,** (Beer, Johnston, Mazurek and Eisenberg).

   Lab Safety:
   - **Required:** Safety Glasses + Closed toe shoes

5. **Specific course information**
   a. **Catalog description:** Loads; structural forms; analysis of axially loaded members, flexural members, torsional members; combined loading conditions; buckling. Basic behavioral characteristics of structural elements and systems illustrated by laboratory experiments.
   b. **Prerequisites:**
      CE 29700 – Basic Mechanics I (Statics) or equivalent with a minimum Grade C-
      MA 26100 - Multivariate Calculus or equivalent with a minimum Grade C-
   c. **Course status:** Required core course in Civil Engineering curriculum.

6. Specific goals for the course

a. Student learning outcomes

On completing this course the student shall be able to:

- Analyze how different types of structural components carry loads i.e. members with axial loads, members that bend, members with torsion, and combinations.
- Determine stresses and strains in these types of structural components.
- Conduct experiments to evaluate the theoretically modeled behavior of these members

b. Relationship of the course to ABET program outcomes

(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. List of Topics:

1. Review of Statics:
   Free-body diagrams, Equilibrium; Distributed forces; Moments of area
2. Stress, Strain and Material Properties
   a. Stresses (Hibbeler: Ch-1)
   b. Strains (Hibbeler: Ch-2)
   c. Stress-strain relations (Hibbeler Ch-3)
   d. Stress transformation; Principal stresses; Mohr's circle (Hibbeler Ch-9)
   e. Strain transformation (Hibbeler Ch-10)
3. Axial loads
   a. Deformation (Hibbeler: Secs. 4.1-4.5)
   b. Thermal stress (Hibbeler: Sec. 4.6)
   c. Stress concentrations (Hibbeler: Sec. 4.7)
4. Bending
   a. Shear and bending moment diagrams (Hibbeler: Sec. 6.1)
   b. Load, shear, and bending moment relations (Hibbeler: Sec. 6.2)
   c. Deformation and stresses (Hibbeler: Secs. 6.3-6.4)
   d. Composite beams (Hibbeler: Secs. 6.6-6.7)
5. Transverse shear
   a. Shear stresses (Hibbeler: Secs. 7.1-7.2)
   b. Shear flow (Hibbeler: Secs. 7.3-7.4)
6. Deflections of beams and shafts
   a. The elastic curve (Hibbeler: Secs. 12.1)
   b. Slope and displacement (Hibbeler: Secs. 12.2,12.5)
   c. Statically indeterminate beams (Hibbeler: Secs. 12.6-12.7, 12.9)
7. Torsion
   a. Elastic stresses and strains (Hibbeler: Secs. 5.1-5.2)
   b. Elastic deformation (Hibbeler: Secs. 5.4-5.5)
8. Combined loadings
   a. Pressure vessels (Hibbeler: Sec. 8.1)
   b. Combined loading (Hibbeler: Sec. 8.2)
   c. Unsymmetric bending (Hibbeler: Sec. 6.5)
9. Buckling of columns
   Euler's buckling formula; Various types of supports (Hibbeler: Sec. 13.1 - 13.3)

Lab Schedule

Lab Prep: T: 8:00am - 8:50am, PHYS-112 – attendance **required** to conduct Lab
Labs: Various times on TWRF in HAMP-G157 – see schedule on Page 1

Week	Date (Tue)	Lab-Prep & Lab
1	Jan-10	Problem Set-1: Cables
2	Jan-17	**Experiment**-1: Cables
3	Jan-24	Problem Set-2: Cables Distributed Load
4	Jan-31	**Experiment**-2: Axial Tension Member
5	Feb-7	Problem Set-3: Trusses
6	Feb-14	**Experiment**-3: Trusses
7	Feb-21	Problem Set-4: Beams SFD/BMD; Plane Stress
8	Feb-28	Problem Set-5: Beams Stresses
9	Mar-7	**Experiment**-4: Beams Stresses
10	Mar-14	SPRING VACATION
11	Mar-21	Problem Set-6: Beam Shear + Deflections
12	Mar-28	**Experiment**-5: Beams Deflections
13	Apr-4	**Experiment**-6: Torsion
14	Apr-11	**Experiment**-7: Combined Torsion and Bending
15	Apr-18	**Experiment**-8: Column Buckling
16	Apr-25	Optional Final Exam Review

8. Grading Basis:

• Homeworks	15%
• Laboratories & Problem Sets	25%
• Midterm Exam I	15% - Mon, **Feb-13**, 6:30pm-7:30pm, LILY-1105
• Midterm Exam II	15% - Mon, **Apr-3**, 6:30pm-7:30pm, LILY-1105
• Final Exam	30% - To be announced.
Total	**100%**
• Bonus: In class activity	10% - Short unannounced Quizzes during lectures

Note: Students must notify the instructor about conflicts with the scheduled exams allowing sufficient time to verify the conflict and arrange an alternate time. Make-up exams for absences will **not** be given except under extremely unavoidable situations.

Academic Integrity

- All work (assignments and exams) that you submit must be strictly **your own work**.
- Obtaining solutions from an external source or from another student's homework and/or sharing your homework with another student is **absolutely not allowed**. Giving and receiving help on **concepts** is allowed and encouraged.
- Academic integrity is one of the highest values that Purdue University holds. 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 table of contents, under *University Policies*.

Take the Purdue Honor Pledge: "As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue."

Classroom conduct

- Attendance is required in **all** lectures, labs and lab-prep sessions.
- **Cell phone** use for talking or texting is **not permitted**.
- **Avoid** arriving late, leaving early, leaving & reentering the class during the lecture.
- Ask questions:
  - **How** does this work?
  - **Why** is this so?
  - Could you please explain again …
- Sit up front and pay attention!

Academic Guidance in the Event a Student is Quarantined/Isolated

If you are quarantined/isolated or have another medical emergency, you may continue to participate in the course online if you are able to. If not, please contact the instructor to request any accommodations or an exemption from the week's assignments.

Emergency Procedures:

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. Information regarding these changes will be posted on the course webpage and you will be intimated by email.

Classroom Guidance Regarding Protect Purdue
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.

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 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. A hyperlink to Purdue's full Nondiscrimination Policy Statement is included in our course Brightspace under *University Policies*.

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.

Mental Health/Wellness Statement
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 the Office of the Dean of Students. Call 765-494-1747. Hours of operation are 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 free and can be done on BoilerConnect.

If you're 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 on the second floor of the Purdue University Student Health Center (PUSH) during business hours. The CAPS website also offers resources specific to situations such as COVID-19.

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.