ME 202
Strength of Materials
Spring 2023
S2

Notice

Instruction

- Instructor: Dnyanesh Pawaskar pawaskar@iitb.ac.in
- TAs: T Sravan (Admin TA), Yogesh Sale, VBS Suryaprakash

Please use “ME 202” in the Subject field of your email

Announcements and document uploads

https://moodle.iitb.ac.in/

Classes and Credits

- 2 1 0 6 credits
- Slot 1 Mon 8:30 – 9:25, Tue 9:30 – 10:25, Thu 10:35 – 11:30
- Exams and additional/compensatory classes may be held at other times by prior announcement.
- Office Hours: TBA shortly

Proposed Syllabus

- Introduction, motivation and recap of basic principles in solid mechanics
- Deflections of beams, statically indeterminate beams, potential energy methods, beams with/on elastic supports/foundation, bent beams, thermal loading, dynamic loading
- Torsion of prismatic solid/hollow/noncircular shafts
- Mixed loading
- Buckling, elastic instability
- Bending of curved members, unsymmetric bending, shear stresses in beams
- 2D boundary value problems in elasticity, thermal stresses, failure: fracture, plasticity

Assessment Scheme

- Quizzes (best 3 of 4 quizzes each 10%) 30%
- Mid-semester exam 30%
- End-semester exam 40%
- Total Score 100%

Optional: Tutorials (can be used to top up your score <= 100) 10%

Tutorials (Optional)

- 1 hour per week but could be split up between classes
- Solve in class and submit/hand-in in class during class hours
- Late submission in designated drop box will be penalized 50% regardless of the reason/no reason
- Discussion with nearest neighbors is allowed and encouraged
- No re-evaluation requests will be accepted/processed
- No notice or at short notice
- Credit mainly for relevant efforts

References

- No prescribed textbook
- Mechanics of Materials, Gere & Goodno
- Elasticity: Theory, Applications, and Numerics, Sadd
- Advanced Mechanics of Solids, Srinath
- Engineering Mechanics of Deformable Solids, Govindjee
- A First Course on Variational Methods in Structural Mechanics and Engineering, Govindjee
- Energy Principles and Variational Methods in Applied Mechanics, Reddy
- Material prescribed by Instructor as we go along

Rules & Regulations - Motivation

- Dual role of Instructor: Coach + Referee/Umpire
- Learning experience is not diminished
- Individual performance evaluation
- Equal treatment/level –playing field (equalize inputs not outcomes)
- Efficient administration

Rules & Regulations - Attendance

- Not mandatory (no DX grade) except for exams. Attendance is encouraged but not enforced. Try looking up “class attendance and grade correlation” “Just showing up is half the battle.” → Those who attend/are attentive class have an advantage/edge over those who don’t.
- Attendance may be recorded but will not be used to award DX grade
- Exam compensation only for medical reasons (certified by IITB hospital) or documented serious family emergency.
- Please enter the classroom on time 😐
- No personal electronic devices in classroom. Need to be stowed away out of sight. But please do answer any urgent/important calls outside the class. Also, bio/beverage/device break outside the classroom is OK!

Rules & Regulations - Exams

- Only pre-approved nonprogrammable scientific calculators. No sharing.
- Mobiles, tablets, VR glasses/headsets, implants, devices, earphones, smart watches, and other equipment must be stowed in the designated “safe zone”.
- Only medically required devices allowed with accompanying doctor’s certificate.
- No interaction with others in any way, shape, or form.
- All exams closed books, closed-notes.
- Self-handwritten single A4 sized (210 x 297 mm, <= 120 GSM) specified cheat sheet OK. No photocopies/printouts/sharing. “The act of preparing a so-called cheat sheet is also an educational exercise, thus students are only allowed to use cheat sheets they have written themselves.”
- Cheat sheets NOT to be returned along with the answer book under ordinary circumstances.
- During exams, only one student will be permitted to take a bio-break at a time with exit and re-entry times to be self-logged.

Rules & Regulations – Academic Honesty

- A zero tolerance policy will be implemented in cases involving academic dishonesty/misconduct/malpractice/fraud. “A zero-tolerance policy is a policy of punishing any infraction of a rule, regardless of accidental mistakes, ignorance, or extenuating circumstances.” (Ref: Wikipedia).
- Please apprise yourself of IITB Academic Code.
- In case you are unsure about the acceptability of any action, obtain the Instructor’s written consent prior to carrying out that action.
- Every case of academic malpractice will be pursued and referred to the disciplinary authorities (DAC) of the Institute for adjudication

Rules & Regulations – Re-evaluation

- Strictly speaking, IITB policy is “view only”
- You will be provided with the solutions and marking scheme to each quiz/exam. You are being offered the facility of submitting any exam for re-evaluation only once. Not applicable to tutorials.
- You may request that your exam be re-evaluated through the use of the designated form only. Re-evaluation requests submitted by any means other than through the appropriate channel will not be considered. Requests sent by other means and other times: email, letter, courier, fax, telex, semaphore, smoke signals, telegram, fax, pigeon post, etc will NOT be accepted/processed 🙃
- Note that the entire answer sheet will be subject to scrutiny which may possibly reduce your total score, and the new marks awarded after the re-evaluation will be final.
- Unsigned, late, incomplete, illegible, unintelligible, or inarticulate requests will not be processed.
- You will forfeit the facility of submitting re-evaluation requests via this method if you submit any frivolous request or if any penalty is imposed on/disciplinary action is initiated against you.

This section is optional - LORs

- This section applicable to only those students who may request me in the future to write letters of recommendation for applications to foreign universities.
- Just getting a great grade (even an AP) is neither a necessary nor a sufficient condition for me to agree to write a letter of recommendation. Academic engagement is important.
- US universities typically look for more info than what's printed the transcript: responsiveness, asking technical questions (during/after class/office hours), pursuing answers to questions, intellectual engagement, demonstrated interest, etc.

Rules & Regulations - Miscellaneous

- These rules will be applicable to all students in the course: regular registrants, special registrants, back-loggers, qualifying test, academic rehab, etc. These rules are subject to change with prior notice. Instructor's discretion will apply to special/unforeseen/unusual/extraordinary situations not covered by this document.
- No compensation for missed tutorials. Exam compensation will be given for medical reasons and serious family emergencies only. All compensation applications to be substantiated by proper documentation.
- No post facto compensation. If you’re not feeling well before an exam, please go to the Hospital and see a doctor first. No compensation granted if you attend an exam even if the medical certificate is produced as a result of a visit to the Hospital after the exam.

Rules & Regulations – Questions?

Proposed Syllabus

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ME 201 S1, S2

- Some course contents may partially overlap
- You may have to get used to possibly new sign conventions, symbols, notation, terminology, etc.
- Exam solutions must be presented using sign conventions, symbols, notation, terminology used in this class.

About this course

- Branch of classical physics
- Emphasis on applications of fundamental ideas developed in ME 201
- Analysis (analysis, design, manufacturing)
- Analytical (analytical, computational, experimental). Some computational.
- Toy problems: highly idealized, geometry/dimensions, material, BCs, loading
- Static equilibrium: no vibrations/impact/rigid body motion/time factor
- Deterministic: No randomness/uncertainty
- Simple (ideas). Not necessarily easy (execution)

Mathematical Familiarity

We'll use applied math as a tool to achieve our goals and not as an end in itself.

You'll need to have working proficiency with:

- Linear algebra
- Vector calculus
- Fourier analysis
- Ordinary differential equations

Objectives/Goals of Solid Mechanics

- Wind turbine (source: ge.com)
- Engineering questions:
- 1.
- 2.
- 3.
- 4.