

# Mechanics of Solids (APL108)

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# Course info

- ✓ **Credit** (3-1-2).
- ✓ **Pre-requisite:** APL100.
- ✓ **Syllabus:** Introduction, State of stress at a point, equations of motion, principal stress, maximum shear stress. Concept of strain, strain displacement relations, compatibility conditions, principal strains, transformation of stress/strain tensor, state of plane stress/strain. Constitutive relations, uniaxial tension test, idealized stress-strain diagrams, isotropic linear elastic, viscoelastic and elasto-plastic materials. Energy Methods. uniaxial stress and strain analysis of bars, thermal stresses, Torsion, Bending and shear stresses in beams, deflection of beams, stability of equilibrium configuration.

# *Course info*

- ✓ **Main textbook:** Advanced Mechanics of Solids by L.S. Srinath.
- ✓ **Supplementary textbooks:**
  1. An Introduction to Mechanics of Solids by Crandall, Dahl, Lardner and Sivakumar.
  2. Elasticity: Theory, Applications and Numerics by Martin Sadd.

# Course info

## ✓ Tentative Lecture Plan:

- Introduction and mathematical preliminaries
- Analysis of stress - Traction vector, types of stress, stress tensor
- Linear and Angular momentum balance; Equilibrium equations
- Principal stresses; Mohr's circle
- Analysis of strain - types of strain, strain tensor, rotation tensor, compatibility conditions
- Stress-strain relations (Hooke's Law), Elastic constants
- Failure Theories

## **Minor Exam**

- Stress, strain, equilibrium equations in cylindrical coordinates
- Energy Methods
- Bending of beams, symmetrical and unsymmetrical beams, shear centre
- Torsion
- Buckling of columns
- Additional topics (depending on time)

## **Major Exam (Full syllabus)**

# *Tutorial guidelines*

- ✓ Students are encouraged to try to practice the tutorial sheet questions before coming to the tutorials. In case that is not possible, try to attend the tutorial and understand the problem and then write your own solution during the tutorial or afterwards. It is only after you have tried the problem yourself that you may look into the solution provided. In addition, you are encouraged to regularly practice questions from the main and supplementary textbooks as suggested above.
- ✓ **Number of tutorial:** 11 to 12

# Quiz

- ✓ **Three** quiz will be taken, **one before the minor exam** and **two before the major exam**. Date, syllabus and mode of the quiz will be informed in due time.
- ✓ Out of these three quizzes - two will be considered for grading purposes.
- ✓ **No re-quiz under any circumstances.**

# *Minor and Major Exams*

- ✓ Minor and major exams will be held according to the institute timetable.
- ✓ Major will be on the entire syllabus, with more weightage on the topics covered after minor.
- ✓ Re-minor and re-major – as per institute policy.

# *Grading Policy*

Component	Weightage (%)
Quiz	20
Minor	25
Major	35
Lab	20
Total	100



# *Attendance policy*

- ✓ Attendance in class/tutorials is strongly encouraged. Students are encouraged to actively participate in the class/tutorials.
- ✓ Students must mark their attendance via Timble.
- ✓ It is recommended that students maintain at least 75% attendance.

# *Policy on cheating*

- ✓ Students using unfair means in exams (including both copiers and copyees) will face strict administrative actions. These may include getting barred from the exam hall, getting zero marks in the corresponding exam and even deregistration from the course.
- ✓ However, please note that students are allowed and even encouraged to discuss the course material, tutorials and lab work with their classmates.
- ✓ But the final answer must be written by the students themselves with proper understanding and not copied from others.

# *Guidelines for lab component*

- ✓ Students must submit lab report of every experiment the following week.
- ✓ The concepts and procedure demonstrated in the experiment must be correct.
- ✓ The final answer, if not exactly correct, must at least be reasonably close to the exact result.
- ✓ The report must be submitted within 30 minutes of the start of the lab.
- ✓ Experimental data must be original and not copied or fabricated.
- ✓ Reports will not be graded if these guidelines are not followed.
- ✓ Each group will be divided into three subgroups and three parallel experiments will be performed in a day.

# *List of Experiments*

- ✓ Tensile test
- ✓ Compression test
- ✓ Buckling test
- ✓ Torsion test
- ✓ Electric strain gauge
- ✓ Impact test
- ✓ Charpy, izod and tensile impact
- ✓ Hardness test
- ✓ Fatigue test
- ✓ Photo elasticity

# *Class schedule*

## ✓ **Lecture:**

- Room Number: **LH 316**
- Schedule: Tue, Thu, Fri (11 AM to 11:50 AM)

## ✓ **Tutorial:**

- Room Number: **LH 510**
- **Schedule:** As discussed in the class. For any clarification on this please contact Vishrut Singh (B.Tech., 4<sup>th</sup> Year, Civil Engg, Email: [Vishrut.Singh.ce120@civil.iitd.ac.in](mailto:Vishrut.Singh.ce120@civil.iitd.ac.in) )

## ✓ **Lab:**

- Room Number: **SOM Lab**, Block IV, Ground Floor, Applied Mechanics Department
- Schedule: Group 1,2,3,4 will follow the schedule provided by the UG section
  - Monday – (2:30 PM to 4:30 PM)
  - Tuesday – (2:30 PM to 4:30 PM)
  - Thursday – (2:30 PM to 4:30 PM)
  - Friday - (2:30 PM to 4:30 PM)

# Teaching Assistants

## ✓ Tutorial:

- Vishrut Singh ([Vishrut.Singh.ce120@civil.iitd.ac.in](mailto:Vishrut.Singh.ce120@civil.iitd.ac.in))

## ✓ Lab:

- **Monday and Thursday: (2:30 PM to 4:30 PM)**
  - Indranil Sarkar ([indranil687@am.iitd.ac.in](mailto:indranil687@am.iitd.ac.in))
  - Tushar ([amz218314@am.iitd.ac.in](mailto:amz218314@am.iitd.ac.in))
  - Abhijit Sahare ([abhijitsahare1@gmail.com](mailto:abhijitsahare1@gmail.com))
  - Neha Pandey ([Neha.Pandey@am.iitd.ac.in](mailto:Neha.Pandey@am.iitd.ac.in))
- **Tuesday and Friday: (2:30 PM to 4:30 PM)**
  - Subrat Kumar Jena ([skjena@am.iitd.ac.in](mailto:skjena@am.iitd.ac.in))
  - Nikesh Kuthe ([amz208464@am.iitd.ac.in](mailto:amz208464@am.iitd.ac.in))
  - Jyotirmoy Pal ([amz238090@am.iitd.ac.in](mailto:amz238090@am.iitd.ac.in))
  - Jerome ([amy237544@am.iitd.ac.in](mailto:amy237544@am.iitd.ac.in))

# *Email*

- ✓ Please email me with your name and entry number if you face any issue or have any request.
- ✓ This applies even if you speak to me in the class. Please follow it up with an email so that I have a record.

## **Thank You**