Course: Engineering Mechanics (APL 100) (3-1-0)
Semester II, 2024-2025

Lecture Schedule and Course Coordinators:

	Morning Lecture (ML): M, Th, 8-9:20 AM	Afternoon Lecture (AL): M, Th, 2-3:20 PM
Course Instructors	Prof. Sawan S. Sinha Department of Applied Mechanics 344, Block IV, sawan@am.iitd.ac.in Office hours: Mon, 4-5 PM	Prof. Rajdip Nayek, Department of Applied Mechanics B-24, Block IV apl100w25@gmail.com Office hours: Thu, 4-5 PM https://coursesam.github.io/APL100W25/

Tutorial Schedule* and Tutorial Teachers:

	Mon	Tue	Wed	Thu	Fri
Morning batch **Room 413.3, LHC** **3- 4 PM**	Groups 1-2 Prof. Sawan S. Sinha	Groups 3-4 Prof. Hari Vemuri	Groups 5-6 Prof. Narsing Jha	Groups 7-8 Prof. Sawan S. Sinha	Groups 9-10 Prof. Arghya. Samanta
Afternoon batch **Room 413.3, LHC** **9-10 AM**	Groups 11-12 Prof. Arghya Samanta	Groups 13-14 Prof. Rajdip Nayek	Groups 15-16 Prof. Ritabrata Thakur	Groups 17-18 Prof. Sabyasachi Chatterjee	Groups 19-20 Prof. Rajdip Nayek

**Tutorial sessions start January 09, 2025.*

A. Textbook:

'Engineering mechanics' by P. C. Dumir, S. Sengupta, and S. V. Veeravalli, Universities Press, 2020. (DSV)

B. Selected references:

1. "Vector Mechanics for Engineers, Statics & Dynamics" by F. P. Beer et al. McGraw Hill, 7th Ed. 2005
2. "Engineering Mechanics, Statics and Dynamics" by I.H. Shames, Prentice Hall, (Third or Fourth edition).

Use these reference books for practicing problem solving. The notation/development followed in the reference books is very different from that of the main text and our lectures. *It is mandatory that all students follow the notation used in lecture notes in all exams/quizzes/tutorial sessions. Use of any other notation leads to massive confusion and ambiguity.*
If you do not follow the notations used in the lecture notes, your work will not be evaluated.

C. Course content:

1. **Kinematics**: Moving point in different coordinate systems; Rigid bodies; Translation and Rotation; Relative motion for translating systems; Angular velocity; General motion of a rigid body; General relative motion; Examples.

(Chapter 1: All sections) [9 hours] – 6 lectures

2. **Axioms and Force Systems:** Mass and center of mass; Resultant force systems; center of parallel forces; Work, power and kinetic energy; Euler's Axioms; Equations of Equilibrium; Impulse and Angular Impulse; Impulse-momentum relations; Dry friction; Belt friction; Free body diagrams; Conservative forces; workless forces.

(Chapter 2: Sections 1-4, 6-14, 17-18, 21-22 and 26. Self-study: Sections 5, 15, 16, 19, 20, 23) [9 hours] – 6 lectures

3. **Dynamics of a Rigid body**: Inertia tensor; Principal axes; Angular Impulse-momentum relations; general equations of motion of a rigid body; motion of a rigid body with a fixed axis of rotation; Euler's equations; work-energy relation; Balancing of rotors; Plane motion with examples; Impact of rigid bodies; Gyroscopic torque.

(Chapter 3: Sections 1-17. Extra Reading: Sections 19, 24) [13.5 hours] – 9 lectures

4. **Statics**: Equations of equilibrium; static determinacy; frames, mechanisms and constraints; Friction and impending motion (rolling and tipping); Journal bearing; Bars, trusses and beams.

(Chapter 4: Sections 1-6, 10-15, 17-19. Extra Reading: Sections 7, 8, 9, 16) [7.5 hours] – 5 lectures

5. **Variational Mechanics**: Hamilton's principle; Lagrange's equations; principle of virtual work.

(Chapter 5: Sections 5.1-5.4) [3 hours] – 2 lectures

D. Tutorials:

- Tutorial sheets will be uploaded on the course MOODLE (and course webpage) and a week prior to the tutorial session.
- Each sheet will be divided into **Part-A** and **Part-B**.
  - **Part-A**: Solutions will be uploaded on MOODLE (and course webpage) along with the tutorial sheet. *Students are required to review both the problems AND their solutions BEFORE attending the tutorials and come prepared to discuss any doubts with the tutorial teachers.*
  - **Part-B**: This section contains the homework assignments. Please do not ask tutorial teachers to provide solutions or hints for Part-B during the tutorials (or even outside of tutorials). You are encouraged to work independently on these assignments to enhance your learning.
- Students must bring the relevant text/problem sets and a calculator to every tutorial session.

E. Assessments:

1. Minor exam: 30 %
2. Major exam: 40%
3. Quizzes: 20% (best two of three will be considered)
4. Tutorial attendance: 10% (=10*total number of tutorial sessions attended/total number of tutorial sessions held during the semester)

A single make-up exam will be arranged for students who miss the minor exam due to medical reasons. **Only medical certificates issued by the IIT Hospital will be accepted. There will no re-quiz.**

To earn an A grade, a student must have more than 80% marks *AND* must be within top 10% of the class. Below 30% will be F grade. All exams, quizzes and final grading will be common for the ML and AL batches.

F. Lecture class attendance policy:

Students are required to maintain a minimum attendance of 75% in lecture classes. If a student's lecture attendance falls below 75%, their grade in the course may be reduced, in line with the institute's policy on attendance. Any student who is caught signing on the attendance sheet for another student in any lecture/tutorial session will get zero on the tutorial attendance part (zero on 10%, Item E.4).

G. Accessibility:

Students with special needs have to send the course instructor an email by the end of the first week. Please inform us about any requests you may have. Students with difficulty in understanding English in the manner in which the lectures are taught, may write to the respective instructor. Please elaborate on the difficulty.

विशेष आवश्यकता वाले छात्रों को पहली कक्षा के बाद रुकना होगा या पहले सप्ताह के अंत तक हमें ईमेल भेजना होगा। कृपया अपने किसी भी अनुरोध के बारे में हमें सूचित करें। जिस तरह से व्याख्यान पढ़ाए जाते हैं, उससे अंग्रेजी समझने में कठिनाई वाले छात्र संबंधित प्रशिक्षक को लिख सकते हैं। कृपया कठिनाई के बारे में विस्तार से बताएं।

H. Miscellaneous information

1. Cases of plagiarism will be dealt with sternly, and all parties involved will receive identical punishment. Finding any evidence of plagiarism will lead to zero being awarded to all parties on that entire exam.

2. Classroom doors close at 8:05 AM/2:05 PM. If you reach after the classroom door has been closed, do not knock and disturb: **just leave**.

3. All course-related material (including lecture notes) will be uploaded on Moodle course (and course webpage) page. Some short-notice announcements may also be posted on this page. Your IITD email will be used to broadcast short-notice announcements. Students are advised to frequently (i) visit the Moodle course webpage, and (ii) their IITD mail inbox for the up-to-date information/activities related to this course.