

Mechanical Engineering, IIT Kanpur
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ME352A Theory of Mechanisms & Machines **Lectures:** MTh 1200:1300 (L4), **Lab:** MTTh 1400:1700 (NL1-204)

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To contact me, use my gmail address and write **ME352A** in the subject line. Makes it easy for me to find your email. I will contact you by emailing ME352A in the iitk.ac.in system. If you are not on the list or your mailbox is full, fix it. Do not phone me unless it is an emergency. Do not email me with doubts just before exam time. Use the full semester.

On labs: The lab slot is common with ME321A and ME361A. You will not have ME352A lab every week. Different groups of students may have labs on different days. A detailed schedule will be provided soon. Do not miss labs if you can help it. Compensation is not assured, even on medical grounds or for going to other institutes for any activities (I will use my judgement). Compensation for two labs will be surely harder to get than compensation for one lab, etc.

Course objectives:

This is a core ME course that stands apart from most other ME courses. It applies kinematics and dynamics (prerequisite: ESO209A) to the study, analysis and design of mechanisms and machines. I will build in a theme of symbolic algebra (e.g., Maple) for handling complicated equations, and numerical solutions using Matlab.

The goal is to be able to examine and understand mechanisms: analyze with confidence, design with basic maturity, and compute with competence.

You will need ready access to a computer. A laptop is desirable but not essential.

Course contents:

Fundamental concepts (mechanisms and machines versus structures; degrees of freedom; motion possibilities; mechanics issues in analysis and design; computational aspects). (6 lectures)

Kinematic analysis, machine dynamics, balancing, dimensional synthesis, cams, gears. (3-4 lectures each)

Evaluation components (full marks 100):

There will be in-class surprise quizzes, between 2 and 20 in number, of unequal weight, duration between 5 and 55 minutes each. No compensation for missed quizzes, even on medical grounds or for going to other institutes for any activities. A policy for dropping one quiz will be developed in consultation with the class near the end of the semester. Quizzes will carry a total of **20 marks**.

Attendance policy. I assume there is value in lectures that cannot be measured in the midsem and endsem exams. So, attendance will carry **10 marks**. I will not necessarily take attendance in every lecture. I will take attendance in more than 10 lectures, and only those will count. If you miss those lectures but attend every other lecture, you will still get zero for attendance. No compensation, even on medical grounds or for going to other institutes for any activities.

There will be one or more computer based exams in institute computer labs. These exams will be held on working days, perhaps in the evening. There will be no compensation, even on medical grounds or for going to other institutes for any activities. Learn use of Matlab in advance, and do all the computations demonstrated in class. These exams will be open book and open notes, but you will not bring any electronic media. You will write your programs from scratch. Experience shows that students with ample printouts but scant prior practice can sometimes fail to type programs in and run them successfully within a limited time format! You have been warned. The computer based exam(s) will carry **10 marks**.

Labs: Labs will carry **10 marks**. However, if you do not get at least **6 marks**, you will receive an F grade. Labs in this course are essential, but not unduly challenging.

Mid-semester (midsem) exam: 20 marks.

End-semester (endsem) exam: 30 marks. Appearing for the endsem is mandatory. No endsem = F grade.

Grading philosophy:

Failing this course is easy.

1. Just miss several labs.
2. Or don't come to any classes (lose 20 on quizzes, 10 on attendance, and then unless you are a genius you will do poorly on exams as well).
3. Or skip the endsem.

Passing this course is also easy.

1. Come to every lab and write good clean reports. (10 marks)
2. Come to every class and don't misbehave enough to be asked to leave. (10 marks)
3. Attempt every quiz honestly. (7 out of 20 at least?)
(And you are more than halfway home already.)

Academic dishonesty (a short essay on cheating):

The intention of the policy given below is not to be harsh or arbitrary. It is to make it easy for you to not cheat.

Cheating is theft. You steal from the weak honest student whose job you take away with your unfairly-earned GPA. You steal from strong honest students whose employability suffers when people outside see that incompetent people also get good grades at IIT Kanpur. You steal from IIT Kanpur by eroding its reputation. You steal from future students of IIT Kanpur, whose careers suffer because their institute's reputation has declined. You steal from the IITK faculty, whose joy in their jobs is eroded over time. And you steal from me, because you compromise my assessment of your competence.

A strong student who helps a weak student is still committing theft. The fact that he is not keeping the fruits of his theft but giving them to a friend is irrelevant. Both giver and taker of help are guilty. Both must be punished. Because not all cases of theft will be caught, punishment will always significantly exceed the magnitude of the crime.

If I think you have cheated, I will give you a fair hearing. Two other faculty members will be involved in a committee that will assess whether you are guilty or not. The quantum of punishment will be decided by me. It will exceed the net value of the activity. For example, if you copy even 1 mark's worth on the 20 mark midsem, you will lose all 20 marks, and may get further penalties (up to and including the F grade). The penalty will be nonnegotiable.

One exception on committees: during in-class exams, if I am invigilating and I find you looking into somebody else's script, then there will be no committee and no hearing. I will punish you on the spot and my decision will be final.

Keep your eyes on your script; do not let them wander. This is elementary in-class exam etiquette. If this gives you a stiff neck, consider exercise or physiotherapy. There is simply no excuse for peeping into other people's scripts.

I may lay traps for cheaters. I will not tell you what they are. You have been warned.

Note: A numerical example. Suppose a strong student can get 18/20, and a weak student can get 2/20. The strong student helps the weak student cheat. Both are caught. With a resulting score of zero on the exam, the strong student loses 18 marks while the weak student loses only 2 marks. Additional penalties may change the strong student's grade from A to D, while changing the weak student's grade from F to F. This example is intended to help you realize that a weak "friend" who asks you to help him cheat is no friend. Help your weak friends before, and not during, exams.

Textbooks:

We will loosely follow

1. Theory of Mechanisms and Machines, 3rd edition, by Amitabha Ghosh and Asok Kumar Mallik
2. Fundamentals of Kinematics and Dynamics of Machines and Mechanisms, by Oleg Vinogradov

When I cover something outside of these books (e.g., some of the numerical work), I will alert you in class. The second book is briefer than the first. The final syllabus will be what is covered in class, not what is in the books.

Good luck. See you in class.