

Transcript of Questions and Answers to Short Interviews from madhuvable.org

What is the objective for creating this website?

This website was created to help in the learning and teaching of mechanics of materials. There will be a wealth of information that will be posted on this site which will evolve over a period of time. Anchoring this wealth of information will be three books: Introductory, Intermediate, and Advanced Mechanics of Materials. Self-learners can view the books theoretical development on-line. This site also provides information how to [obtain low cost copies](#) of the books, solution manuals, and other instructional material for teaching of the three courses.

What is Mechanics of Materials?

Mechanics is the body of knowledge that deals with the relationships between forces and the motion of points through space, including the material space. Material science is the body of knowledge that deals with the properties of materials, including their mechanical properties. Mechanics is very deductive—having defined some variables and given some basic premises, one can logically deduce relationships between the variables. Material science is very empirical—having defined some variables one establishes the relationships between the variables experimentally. Mechanics of materials synthesizes the empirical relationships of materials into the logical framework of mechanics, to produce formulas for use in the design of structures and machines.

What are the practical applications of mechanics of materials?

Mechanics of materials principles are used in product design in which strength and/or stiffness are important. A building falls because it had poor strength design. You cannot open a sauce bottle because the bond between the bottle and the lid was made too strong. A bridge sways because it was not made stiff enough. A diving board was made too stiff making it useless for diving competitions.

The mechanics of materials principles are also used in the measurement and control of forces. Bathroom scales are an application of measurement of forces. Robotic controls, be it in toys, automotive assembly lines, or in the Mars rover, all rely on accurate control of forces. The same principles of measurement and control of forces are in smart structures such as bridges that monitor their own health, airplane wings that change shape as they fly, and buildings that counter the movements of earthquakes.

The applications of mechanics of materials principles are not just limited to human artifacts, but also provide explanation of natural phenomenons. Earthquakes are the result of the earth releasing its stresses, which is a variable used in mechanics of materials for measurement of strength. Our bones and muscles become stronger by subjecting them to right set of stresses. As we mimic nature in creating new designs, the principles of mechanics of materials will continue to play an important role.

Why do you write books?

I love logic. Logic organizes ideas making it possible to organize vast amounts of information in our minds. In mechanics of materials, there is a logic that flows from the introductory course to the advanced. I have been trying to show its beauty and power to my students. This logic permeates my three books.

Another love I have is of teaching. The essence of good teaching is a strong desire to explain to others what you have been fortunate enough to understand. Textbook writing takes this component of teaching and integrates it with the scholarship of synthesis.

The need for scholarship of synthesis has never been greater. Research advances are fragmenting our knowledge at a very fast rate. Even though the principles of mechanics of materials have not changed since my undergraduate days, the presentation of these principles must continuously evolve to provide students with a foundation that will permit them to readily incorporate the growing body of knowledge as an extension of fundamental principles and not something added on, and vaguely connected to, what they already know. This sentiment is beautifully enunciated by Will Durant in his book *Story of Philosophy*:

“If knowledge becomes too great for communication, it would degenerate into scholasticism, and the weak acceptance of authority; mankind would slip into a new age of faith, worshiping at a respectable distance its new priests; and civilization, which had hoped to raise itself upon education disseminated far and wide, would be left precariously based upon technical erudition that had become monopoly of an esoteric class monastically isolated from the world by the high rate of terminology.”

What are the differences between the three books?

All three books share a common notation and a common style of presentation. The logic that I talked about earlier permeates the three books. Practical applications dominates the introductory book, and more mathematical considerations dominate the advanced book, with the intermediate book falling in the middle of this practical-mathematical spectrum.

In the introductory book the students are introduced to the mechanics of material variables, how they are related to form the links in the logic chain, and how the logic is used to create formulas for the simplest theories of one-dimensional structural members. These formulas are used for design and analysis of simple structures and machine components.

In the intermediate book, the modularity of the logic is demonstrated for one-dimensional structures by incorporating complexities such as temperature, material non-homogeneities, material non-linearities, geometric complexities. The new formulas developed by incorporating these complexities are once more used for design and analysis of simple structures and machine components.

The advanced book brings to the fore the full beauty and power of the logic. Complexities described for the intermediate book are incorporated not just for one-dimensional structures but also for plates—a two-dimensional structural member. Though more sophisticated solution techniques are introduced for simple theories, there is great emphasis on development of more complex theories with the expectation that the students will learn the solution techniques for these complex theories in other graduate courses or as part of their research.

What is the time schedule for the development of this site?

There is very little time to work on books during the academic year. Most of the work has to be done during the summer months. This website has the intermediate mechanics of materials book already posted. The second edition of the introductory book is already posted on another website [accessible here](#). The first edition of advanced book is expected to be complete by January 2016 and will be posted then, followed by the third edition of the introductory book in January of 2017. The site will continue to evolve based on the input received from the visitors to the site. Visitors can keep themselves informed by registering themselves on this site.

Purchasing Book and Instructional Material

The Intermediate Mechanics of Materials and Solution manual can be purchased as an *e*-book or a print copy from Amazon.com on [this link](#). The purchased copy has post text problems for educational use that

are not included in the freely displayed on-line version. Print copies cannot capture the shades and gradients of grey that are seen in the on-line book and in the *e*-book.

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