

**Modern Construction Materials**  
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**Module -01**  
**Lecture -00**  
**Prologue**

Hello and welcome to Modern Construction Materials. I am Ravindra Gettu; I am a professor of civil engineering at IIT, Madras. And I been teaching modern construction material as the course at IIT, since 2005. So it is about seven years since I've been teaching this course. Before I joined IIT Madras, I was researcher and the head of a structures lab of Barcelona, Spain. And before that I did my Ph. d at Northwestern university, I got my master from Market university again in the U S. And my bachelor degree is from the university of Madras, I studied in the government college of technology, Coimbatore; so that is the little bit about my background.

When I have the first class of this or any other course, I go through an exercise of trying to know this student better. And this is something that I would suggest that teachers follow. And we will try to do it on video also let see. So what I have people do, the people were attending the class, do is close their eyes for a minute, blank out everything, start of I say reboot and then we will try to find out what's the long term goals are of the people attending, that is the students. And also what is the expectation from this course.

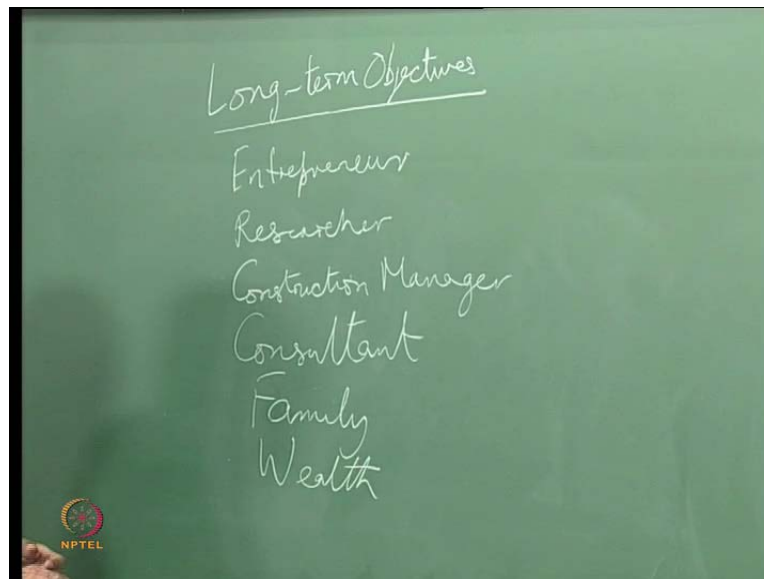
So let us try it out even though you are not sitting in my class and you are in front of your computer or T V Screen. Let us see if you can do this. So you can put the video on hold and close your eyes for a minute and blank out everything and then we will see, what what you will come up with in terms of your goals and your objectives for this course. So close your eyes for a minute, you can put the video on hold and then you come back and then play when you blank out everything.

So, so you done this, now again close your eyes and hopefully you have something that you can write on. So this time close your eyes for a minute or so again you can put the video on pause and when you open your eyes write down what you think would make you happy to have achieved ten years from now. So, ten years from now, what you think, you would be or you

should be to have had a successful carrier. Ok So, close your eyes, and do this and come back. So when I do this in class, I have a range of answers from the students, and generally in the course on Modern Construction Material when I teach it, I have an M.Tech student of building technology and construction management. I also have M.Tech students from the program that we have in Larson and Turbo, by we have students with some experience on site, so slightly older students in the program of construction technology and management.

Then we have some dual degree students that is the students would be the fourth or fifth year and research scholars what doing their M.S and Ph.d. So there is a range of people who could be sitting in class. And the answers that we get about their thoughts on where they will be ten years from now also varies. And now you would have written what you want to be ten years from now. And let me some of the answers that I get.

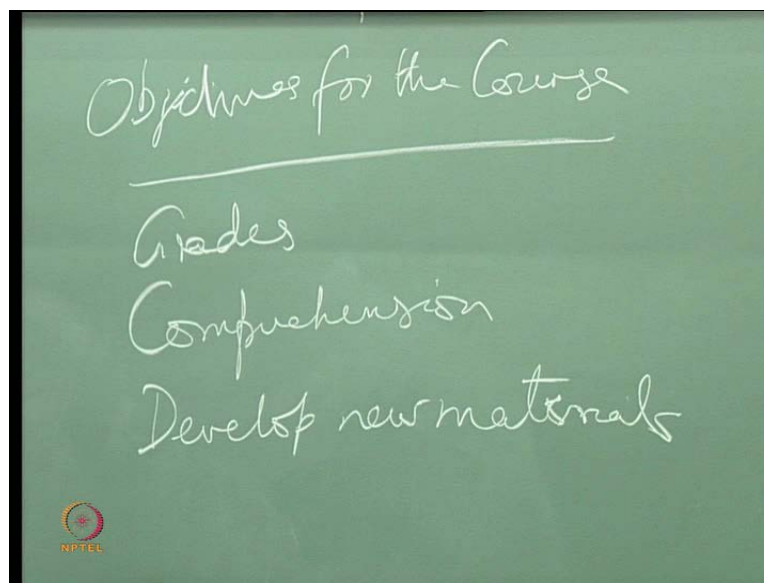
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So the long-term objectives could be becoming an entrepreneur, becoming a researcher, a construction manager, may be a consultant. Or it could be something not really related to the field, it could be that the main objective would be to have a happy family, or it could be wealth may be the most important thing that the person could desired would be to be rich. So there is no right or wrong answer, but as a teacher, it tells me, and if you are a teacher, it will tell you about what are the things that student's aspire something about the entry behavior we need sometimes refer to.

Now what we will do now is now that you know where the students want to go ultimately and you know what by you want to be ten years from now. Now close your eyes again and now when you open your eyes, write down what do you want from this course. Why are you watching this video, why are you taking this course, I will say my would ask my student, why are you doing this. So close your eyes for a minutes, and then again you can put the video on pause and then come back and play it again. Now when I suppose you have written down what do you want and again the answer is get from class vary a lot.

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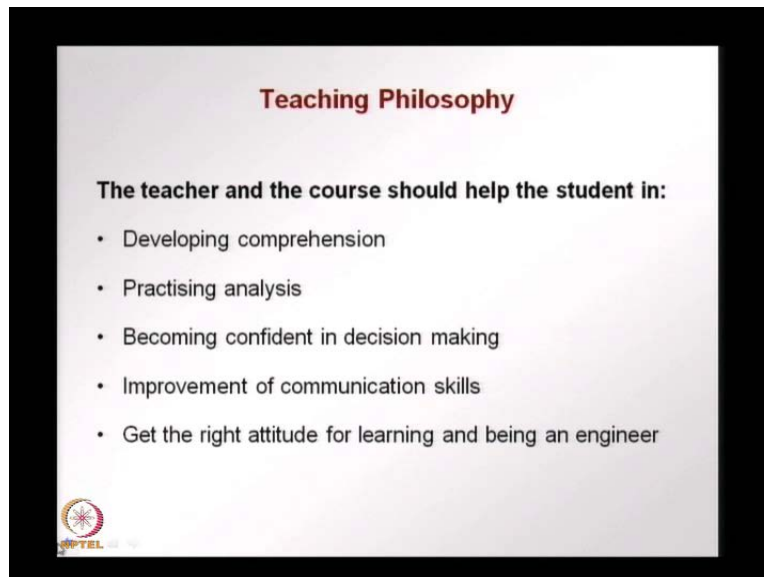


So let us look at some of the answers. So the objectives for the course could be as simple as getting grades, or comprehension – they want to understand about the subject, or it could be develop new materials or to understand what can be done in terms of material science or material engineering and things like that. So it could be that simply a person is studying, because they have to, they have to get good grades, they have to pass this course; in your cases, it is not like that. Generally it could mean that, you want to develop a comprehension you want to understand improve the knowledge and get the basics of materials engineering related to construction materials. And hopefully, there is a link between the two column. They should be a link between these two, the long term goal and why you are sitting here for this course.

If there is no link, then you making a mistake. You need not have to go through this and I am telling you this as I tell my student that if you do not know why you are here, and if you do not

know why this course is at all useful to you then you making a mistake. We have to understand where we are going and hopefully whatever you do everyday we will lead you to this course. This is something that is very important as a teacher, it tells you what the student expects from your course, and what you can deliver. Now I want to tell my students what my goals are, and what I will try to deliver. My long-term goal would be that what I teach and the research that I do, ends up in something useful in terms of a landmark structure or development of a new technology or the use of a new technology and something pioneering that will make me happy, ten years from now if you look back and see that this has happened.

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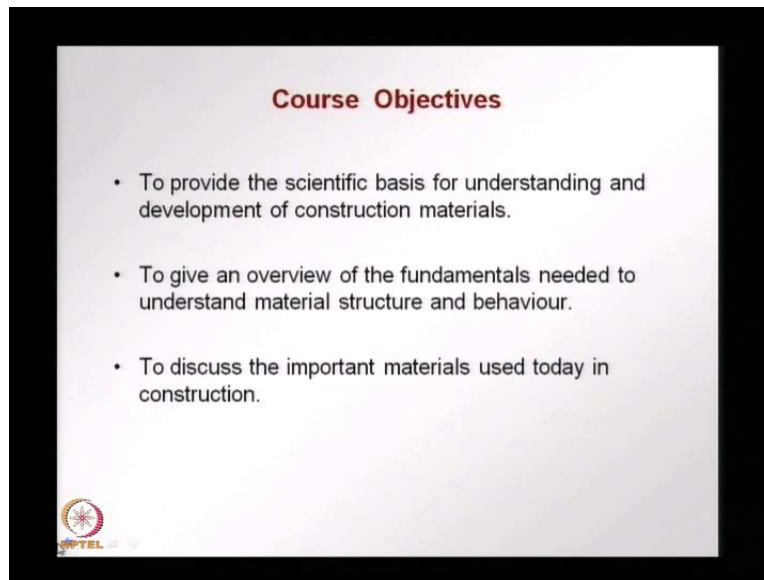
Short-terms goal what can I give in this course. In terms of what I would like to give in this course and what I think a teacher should be able to develop in a course should be this. Developing comprehension so that understanding is improved, the breadth of knowledge is improved and that is what we will try to do in terms of construction materials in this course. Secondly and very important the analysis, we always have choices, we have prose and content there is no clear-cut answer always in engineering and technology. So we will should have the ability to analyze choices from different angles, and this is something that we do everyday in our personal life and this similar types of analysis is needed in engineering, if you are at the site or you are at the design office or you are a manger of a project.

Thirdly, the above two leaves on to the third aspect, which is becoming confident in decision-making. You after you have the choices, finally you have to take a call on which material to use, which technology to use and how to go about it. And this is something that you will see that has to be done in the context of this course. We have a lot materials which can be used in a certain applications. We have to decide which material to use. These choices become very wide when we go to finishes and fittings an accessories, there is a tremendous choice and this choice seems to be increasing in all parts of the ((Refer Time: 10:16)). Now how do we chose, what do we choose and how to reach this decision. It is important that during the course the student develop this ability to understand, analyze and reach a decision.

The other two aspects of what I try to develop in a course that is start directly is communication skills and attitude. Communication skills comes through report writing, assignments and so on. This is something that you will have to do you are share as far as this video course is concerned, but this is probably as important as the other three aspects. Because unless you are able to communicate well as an engineer, you will not be able to convince others that what you are saying is correct, you will not be able to convince others that your decision was taken rightly. And we find lot a times that student was very good in taking exam, in answering question, they are not able to do well report writing, communicating their results or their decision.

So in today's world, it is very important that we develop this ability to communicate well with others who might be a superiors, your clients, the users of the structures that we are building and so on. Lastly, attitude is always an issue. They should be a right attitude to learn that the fact that you are sitting in front this T V screen or computer screen means that you have the attitude. This attitude should continue. Only if you have the right attitude for learning, and for being a complete engineer one can be successful and I hope that this course goes to some extend in helping you this way.

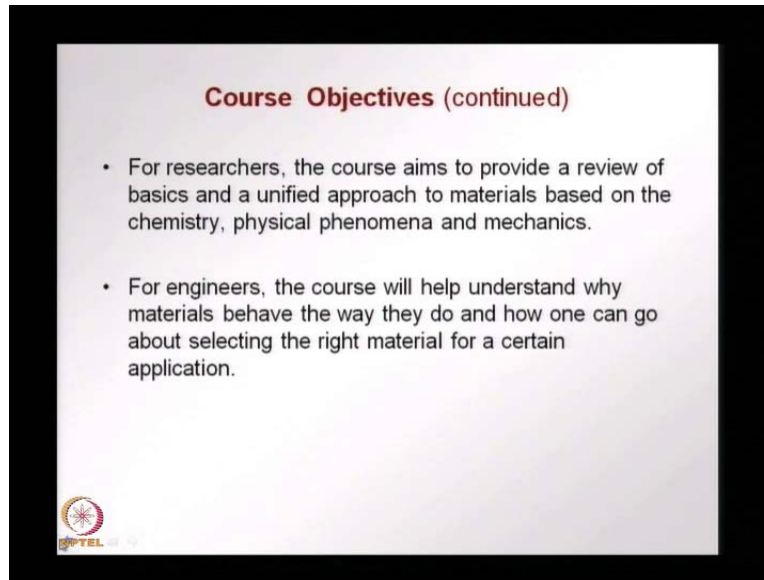
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What are the objectives of this course? First of all to provide the scientific basis for understanding and developing of construction materials. We will provide the basics, the science behind the behavior and properties of construction materials. And we will spend a lot of time discussing the important construction materials of today. We will span the range of materials that have been probably used for centuries, if not thousands of years, like timber. Going on to modern materials like fiber reinforced plastics and other finishing products that are coming into the market today and being used more and more today than ever before.

Now in this course, we will assume that you have had some course in building materials before, say in first or second year of engineering; assuming that you are a final year student or close to the final year of engineering or in the beginning of the post graduate program. So you should have read something on building materials, covering the usage of materials, the basic properties and I also assume that you would have some courses in chemistry and physics, so they will be only a review of these aspects and it will not be a comprehensive.

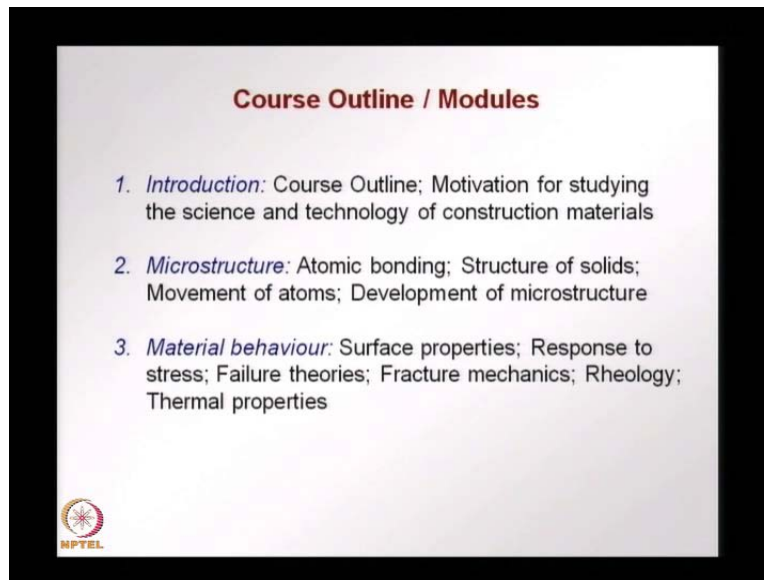
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Now this course is expected to help not only people, who are studying now, but also people who are practicing engineers and people who are starting of their carrier as a researcher. For the researcher, I hope to provide through this course a review of fundamentals and a unified approach to looking at materials. Not studying one material at a time, because for research you have to understand why things happen in the material and why you get the properties that you have only then you can improve a material or develop a new material. So a material science approach will be taken here, where fundamentals will build up, reviewed and you go on to see understand why material behave the way they to do.

Similarly, for engineers, practicing engineers, it is good to understand the properties where they come from and the behavior of materials. And often as an engineer, you will find, I am sure that you will find through your carrier that you will come across materials that you have not studied before. Because this is just come out to the market and you have not had a course which dealt with that particular material. Understanding the family of materials and fitting in the new material to this family, you will know how to deal with this material and hopefully also be able to predict how this material will behave in this application that you are dealing with. So this course, I hope will help you not only as a student but also if you are thinking of researcher as a carrier and also if you are a practicing engineer.

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So this is the course outline, it is put into several modules and how you should follow this course is that go through the video, each video. We will try to have a question answer session thinking of possible questions that could come up and answer those other than that they are exercises that will be given for each module. And in some cases we will also try to do some demos or show how the material look not only in picture but you will see in at least in the studio, we will have the material so that you get a better feel for how the material looks like. But I would encourage you to have a text book, read material on the web or in your library or any library that you are close to so that you get more information. This course is by no means comprehensive; we do not cover everything that you should know about any of the topics given here. It is more of a review and in some cases we do go into some depth but it is no mean comprehensive.

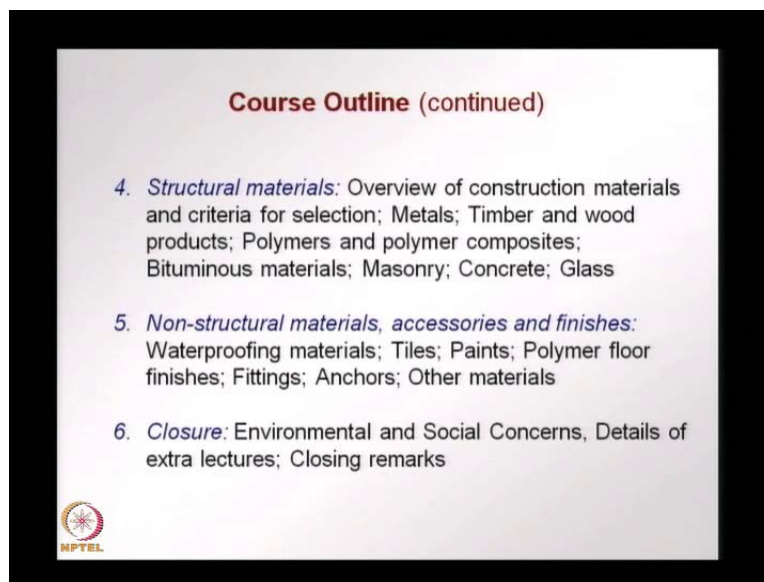
So in the first module, after giving the course outline, I will talk about the motivation for studying the science and technology of construction materials. This is again not very common; most curricula will not have the material science explained in civil engineering. We generally traditionally have dealt with material by material; there will be a course which starts with cement then aggregates then concrete, timber and so on. But here in IIT Madras, we believe that the student should have an understanding of the fundamentals before the material is actually discussed. In the second module, we will look at atomic bonding, structure of solids,



movement of atoms within the structure and development and changes in the microstructure. So this will tell us how material are put together. What chemical and physical laws govern the development of the microstructure, anything that required the microscope is what we classify as microstructure.

Then we go onto look at material behavior that would be the third module may be look at surface properties; response of material to stress; failure theories; fracture mechanics will be introduced; we look at Rheology which is the science of how materials flow and thermal properties which are off very high consequence in civil engineering. So the material behavior follows from the microstructure and from the examples, you will be able to understand why the material behaves in a certain way and what are the fundamental aspects that leads to this behavior.

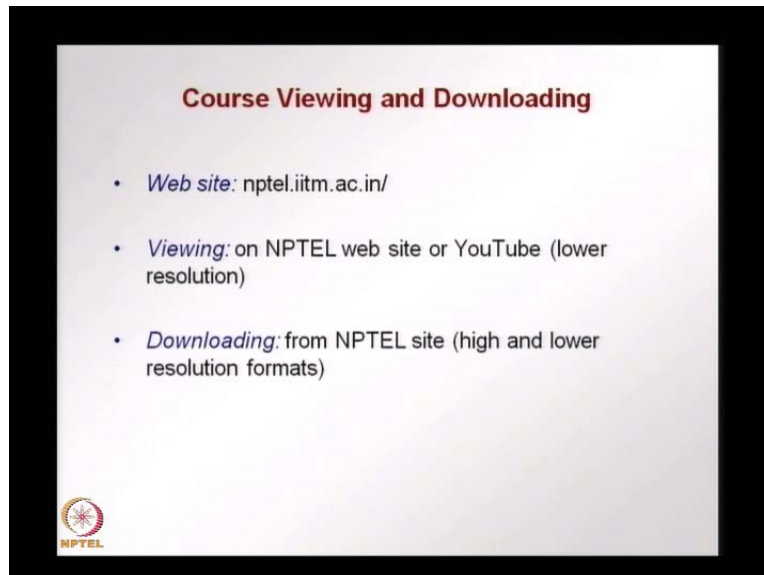
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Then we will go onto two modules specifically on materials; first we will look at the structural materials that is used to make the skeleton or the shell of the structure that we used and ((Refer Time: 29:24)). Before that the overview of different construction materials, how we make choices, how do we decides to use certain materials. We will cover materials commonly used like metals, timber, concrete, asphalt and so on. We will also touch upon glass, which is becoming a very important structural material. Glass is not confined to just windows and shutters, but also it is being used as glazing which as a structural component of a building.

Then we look at non-structural materials, accessories and fittings like floor finishes, waterproofing; tiles; paints; anchors and so on. These are also important, because you have wide range of choices and in terms of budget sometimes if you find that non-structural materials are as important to your pocket when something is being constructed. Finally, when we close in the last module, before I give my closing remarks, we will look at environmental and social concerns. How does the choice of the material help in the impact on the environment, can we make a choice such that the environment is least effected. Also we look at social perception of materials, why do we choose a certain materials, why do people likes certain materials and they do not; beyond jus the technical aspect.

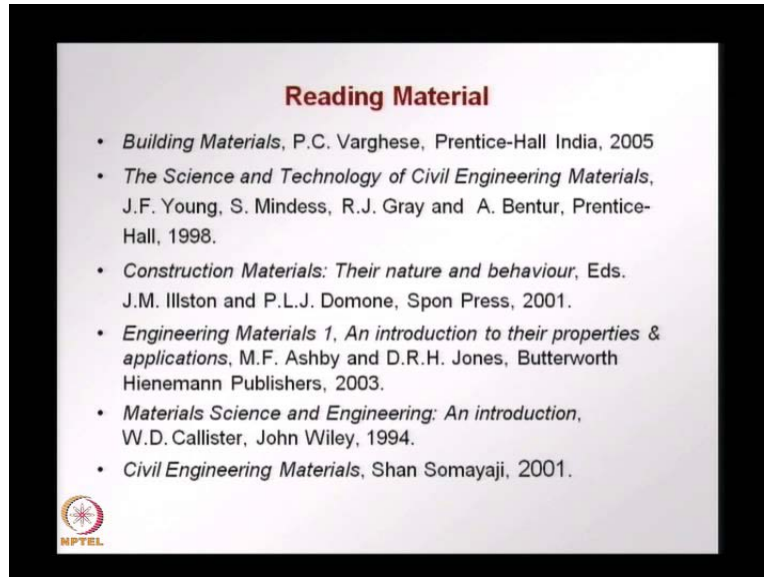
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In terms of how you access this course and how you can use the course, you already know that the website for the National Program of Technology and Enhance Learning is nptel.iitm.ac.in. So this course is a civil engineering course within this program. You can view the videos of this course on the NPTEL website or on you tube. You tube you would see the video in lower resolution, best would be to download the video. You can download the video is in higher all low resolution and that way you can see them often and you can see them leisurely, you can stop and proceed and so on. So the best way to follow this course would be to have downloaded the video. And as I said get reading material to along with this course. And ideally I would suggest that along with each lecture, do the reading corresponding to that lecture. And the end of the each

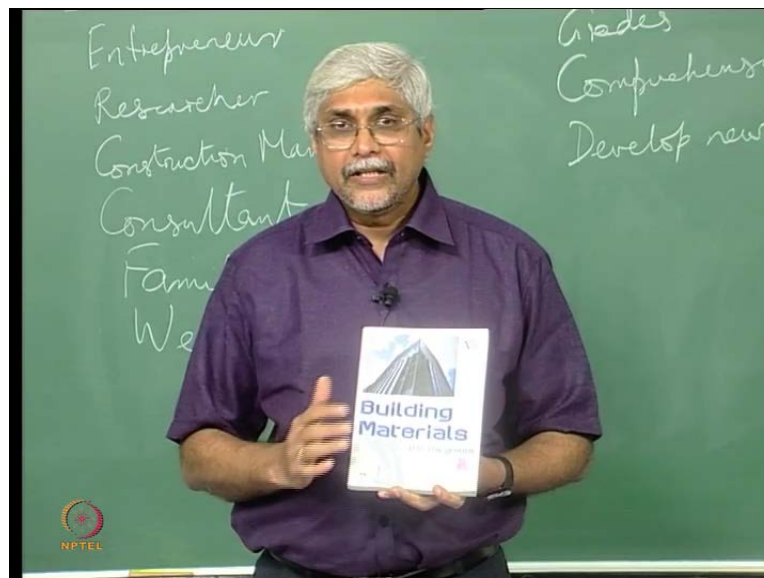
lecture, I give the reference in the NPTEL site you will also have text giving you list of reading material.

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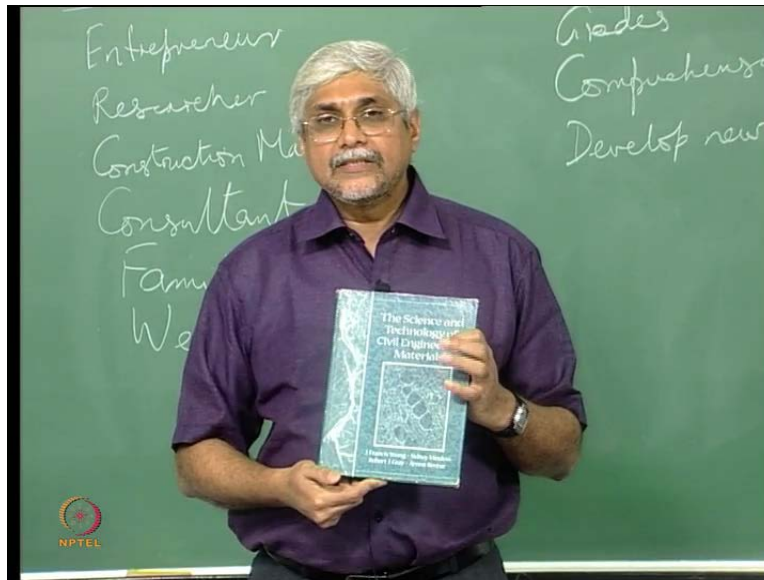
Now these are some of the books that I have used and the first one on Building Materials is something very basic.

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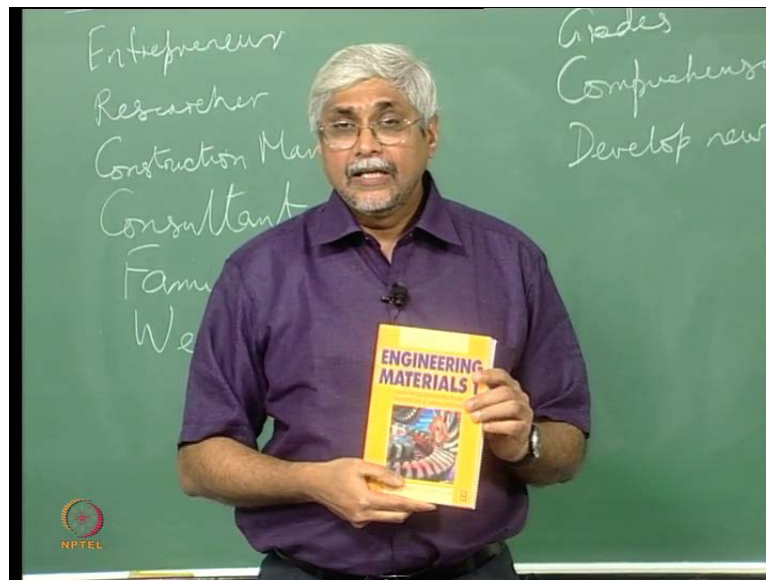
Actually, this is the book that I use the book of P C Varghese. What I would expect is that you have read a book such as this before you start with this course. We start from this as the foundation. So you have read, you should have gone through in your course work or by yourself the material covered in a basic fundamental book of building material such as this.

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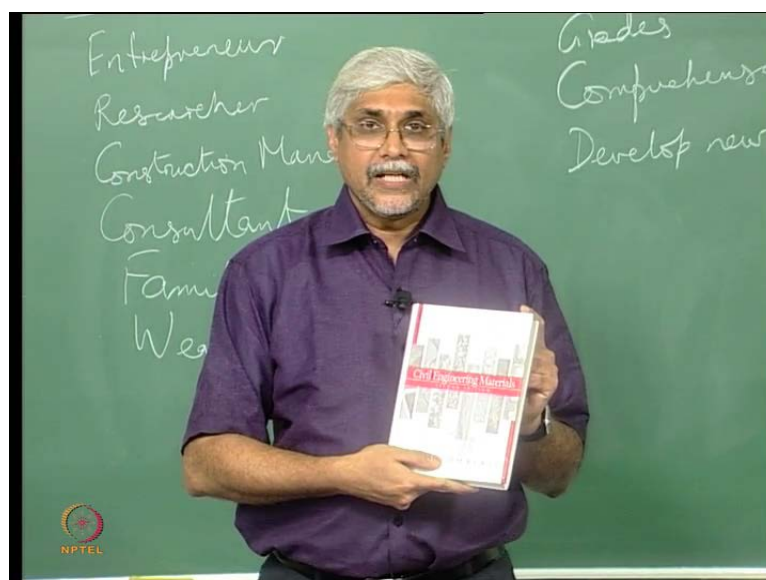
Now as I told you, we have structure this course from the material science point of view and this was not very easy and one of the sources which gave inspiration in lot was this book on Science and Technology of Civil Engineering Materials by. And this book has helped us develop this course, starts with the fundamentals course through the different properties and then covers material by material. So this is the book that if you can get your hands on would be excellent.

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An another book not pertaining to civil engineering, but has been very helpful as course material, is this book by Jones – Engineering Materials- I. And it is an interesting book because it has short chapter, and for teachers it could be interesting, because the author have structured the book such that all the material need for one lecture is given in one chapter. So the twenty seven chapter, so if you plan the course well, you can deal with all the materials dealt with each chapter in each of these lectures.

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There are another book also, another book that I have here on the list is Civil Engineering Materials by ((Refer Time: 24:25)), this is the very popular book all over the world, and this can help you in many way. So I hope we will have good course together and at the end of the course feel free to send a feedback. You can do with through a NPTEL site and if there are any errata, we will also flag it through the NPTEL site, so you will know if something are changed need to be change.

Thank you and I am looking forward to having you in the first lecture.