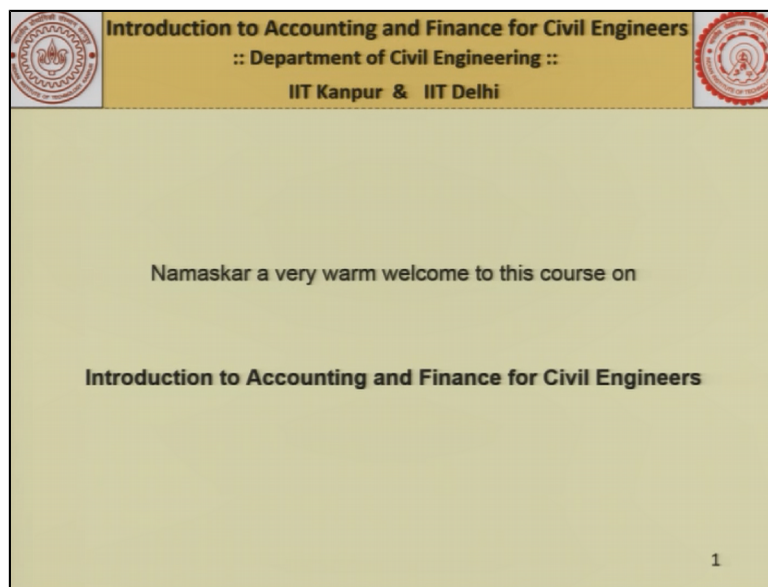


**Introduction to Accounting and Finance for Civil Engineers**  
**Professor. Sudhir Misra**  
**Department of Civil Engineering, IIT Kanpur**  
**Professor. Kumar Neeraj Jha**  
**Department of Civil Engineering, IIT Delhi**

**Module No. #01**  
**Lecture No. #01**  
**Overview of the Course**

Namaskar, and a very warm welcome to all of you, to this course on, Introduction to Accounting and Finance for Civil Engineers.

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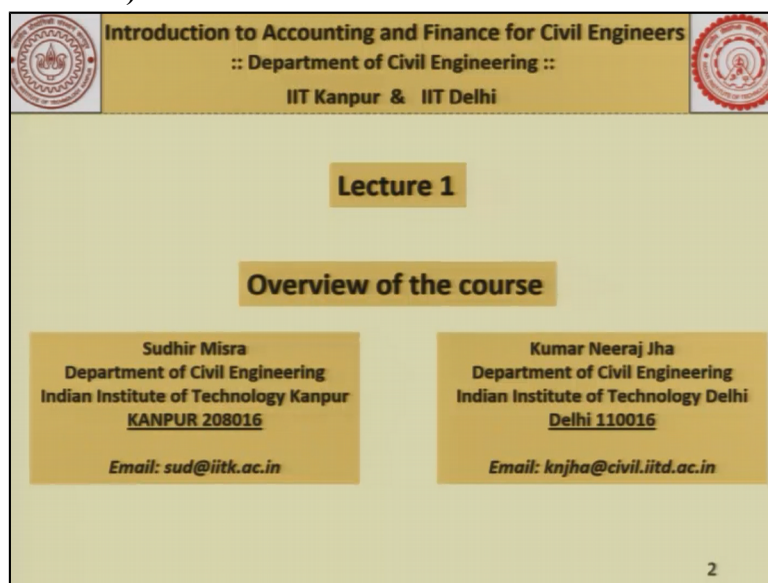
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**:: Department of Civil Engineering ::**  
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Namaskar a very warm welcome to this course on

**Introduction to Accounting and Finance for Civil Engineers**

1

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**Lecture 1**

**Overview of the course**

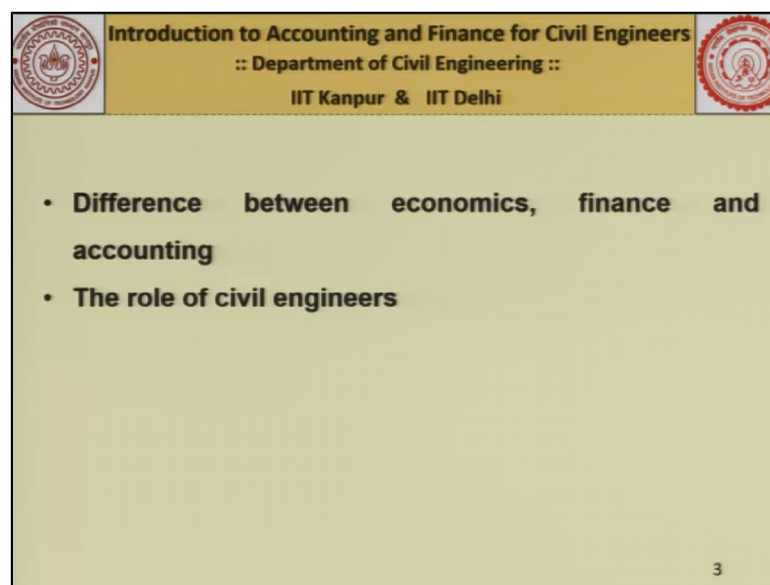
<p>Sudhir Misra Department of Civil Engineering Indian Institute of Technology Kanpur <b>KANPUR 208016</b> <i>Email: sud@iitk.ac.in</i></p>	<p>Kumar Neeraj Jha Department of Civil Engineering Indian Institute of Technology Delhi <b>Delhi 110016</b> <i>Email: knjha@civil.iitd.ac.in</i></p>
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2

So, in this first lecture, we will do an overview. Before that, let me introduce myself, and my colleague. My name is Sudhir Misra. And, I teach at the Department of Civil Engineering in IIT Kanpur. I have been here for about 25 years. And, I leave it to Professor Jha, to introduce himself, and proceed with a few slides.


Good morning to all of you. I am Kumar Neeraj Jha. I am with the Department of Civil Engineering, IIT Delhi. I am with this department for last 11 years or so. Prior to that, I was at IIT Kanpur, for a big period. And, before that, I was working for Larsen and Toubro limited, for quite some time.

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Now, I just introduce you to the few key terms, that we will be encountering in this particular course. We will be dealing mostly with, construction economics concept, the concepts of finance, and the concept of construction accounting. We will also tell you briefly, the role of civil engineers, or for that matter, any engineer in the modern context. When it comes to construction economics, it is basically the allocation of scarce resources.

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- **Construction Economics: Allocation of scarce resources profitably**
  - ✓ Labour and Staff
  - ✓ Equipment
  - ✓ Material
  - ✓ Money
- **Construction Finance: Allocation of financial resources profitably**

4


Now, as you know, in any construction projects, we employ a large number of labour forces, we employ a large number of staff, we have plenty of equipment, we have plenty of material, and we have lots of money involved. These are the typical resources, in any construction projects, we employ. Now, when it comes to construction economics, it is basically the allocation of these resources, in a profitable manner.

On the other hand, when we talk of construction finance, it is the allocation of financial resources, in a profitable manner. I will also introduce you to the term construction accounting, which is slightly different from other accounting systems.

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## Accounting

- Accounting can be called the language of business, and like any language aims at effective communication of business transactions.
- In principle, accounting can be defined as a system of recording, collecting, summarizing, analyzing and presenting information about an organization or project in monetary terms.
- The findings of the above exercise are usually presented as one of the following
  - ✓ balance sheet,
  - ✓ profit and loss account, or
  - ✓ a statement of changes in financial position.

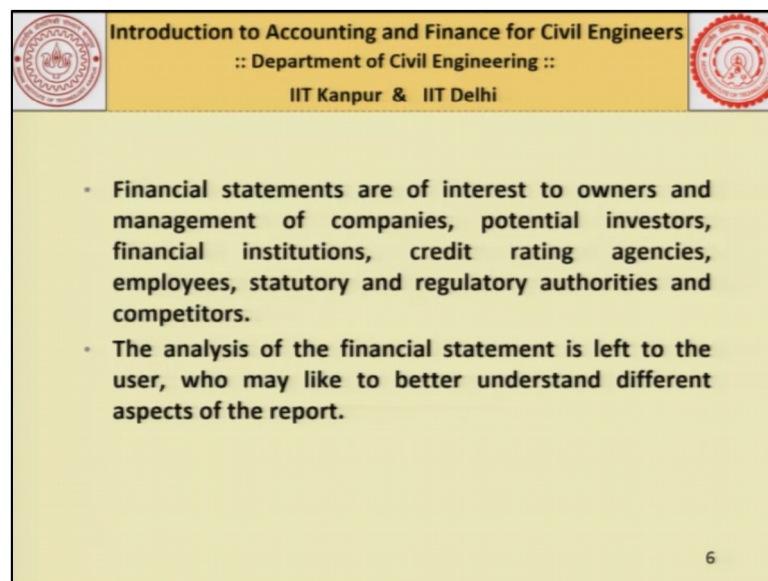
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Because of different reasons, we will see, when we come across in some other lecture. But, as far as construction accounting is concerned, it is like any other language of business. And, as

you know, in any language, you have to follow certain rules. For example, how to record a transaction in construction accounting, how to summarise those transactions, how to prepare reports out of those transactions, so that it gives a useful information.

We will like to introduce you to these concepts. We will also introduce you to some of the key reports, that we generate, at the end of accounting processes, which are namely, balance sheet, the profit and loss account, and the statement of changes in financial position. Now, you would be wondering, why at all, we are giving emphasis on this accounting.

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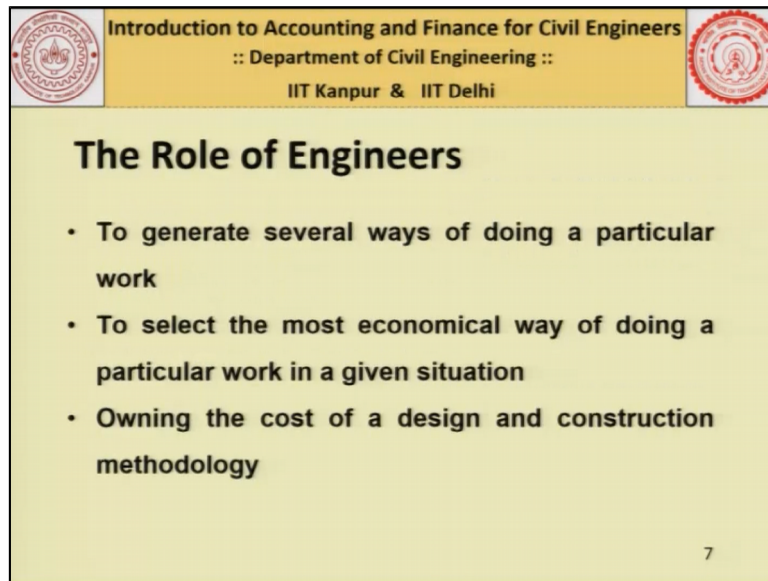


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- Financial statements are of interest to owners and management of companies, potential investors, financial institutions, credit rating agencies, employees, statutory and regulatory authorities and competitors.
- The analysis of the financial statement is left to the user, who may like to better understand different aspects of the report.

But, as you know, accounting is a very important aspect, in any business. And, it is not only helpful for an engineer, but it is helpful to many stakeholders, as we will see. For example, if you look at financial analyst, or a credit rating agency, or for that matter, as an employee itself, you would like to see, how your company is functioning. What are the key parameters on which, it is lagging? What are the key parameters in which, it is showing good signs? So, you will find, depending on the stakeholders, these financial statements convey a lot of information.

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## The Role of Engineers

- To generate several ways of doing a particular work
- To select the most economical way of doing a particular work in a given situation
- Owning the cost of a design and construction methodology

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Now, as I told you, also have to understand the role of engineers, in today's context. Now, gone are the days, when the role of engineer was to just come up with a design. These days, your design is not complete, until unless, you talk in terms of the cost. So, as an engineer, you have to find out a number of alternatives, to do a particular job. Let us say, for example, we are working for a construction project, and we are producing concrete.

Now, there are different ways in which, we can produce concrete. For example, it could be manual concreting, it could be concrete production with the help of a 10/7 mixer, it could be a batching plant, or it could be a ready mix plant itself. Now, you will find that, the cost of producing the concrete, through each of these different methods, may change. Now, as an engineer, you have to find, which one is the best alternative for a given situation.

Sometimes, you are producing very small quantity of concrete. It could be a manual mixing method, that would be economical. But, when you are producing large amount of concrete, you may find that, establishing a batching plant would be the most economical option. So, as an engineer, the role of yours would be to generate a large number of alternatives, to do the same job, and to find out, which one out of them is the best one.

Owning the cost of a design, is very important. It is not enough, just to give the design. But, you also have to talk in terms of cost. Now, coming to the different modules in this particular course, we have organised it in small, small modules, so that it becomes more focused.

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**Modules in the course**

- Introduction to economic decision making
- Construction equipment costs and revenues
- Cash flow analysis
- Economic analysis in the public sector
- Basic terminology of accounting
- Financial accounting systems
- Construction accounts and financial statements

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So, we will start with, the introduction to economic decision-making. We will let you know, what are the key situations, as an engineer, which you face. We will also like to introduce you to, different construction equipment, how do we carry out their costing, how do we generate revenue out of them. Then, we also like to introduce you to, the concept of cash flows. Because, you will find that, any construction company, it enters into a large number of transactions, on a daily basis.

When we talk of transactions, it is basically the flow of money, from one hand to the other. So, a number of transactions are entered in a company on a daily basis. For example, you may be getting the salary, you may be realising the bill from your client, you may be paying to your suppliers, you may be paying to your construction equipment hiring agencies. So, these are different ways in which, cash is coming to the company, as well as, cash is going out of the company.

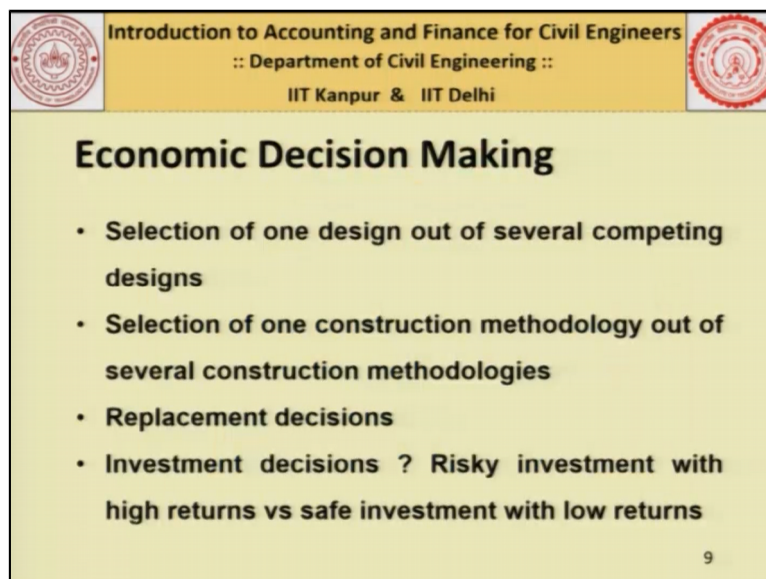
So, we try to put them in the form of a graphical representation, so that it gives you a correct picture, at what point of time how much money entered into the system, at what point of time how much money went out of the system. We will also like you to introduce you to the concepts of evaluation, in the context of public sector. As you know, private sector working, and public sector working, the purpose are different. In the public sector, we do not give emphasis on profit-making, or those financial issues. But, as you know, government also has got limited funds.

So, different projects are competing. And, in order to find out, where we have to invest money, we need to do carry out some analysis. We will introduce you to the basic terminologies of accounting. For example, we would introduce you, what is a ledger, what is a journal, what are cash transactions, what are credit transactions, what is a single entry system, what is a double entry system. And, we will introduce you to different financial accounting systems also, in the context of construction.

Remember, construction is a slightly different, compared to other accounting systems. Because, when we talk of any construction project, it spans into a long period. So, some of the projects may be running into 4 or 5 years. So, you find, it spans over different financial periods. We will try to introduce you to construction accounts and financial statements. As I told you, we will introduce you to the balance sheet, as well as profit and loss account. As, you will understand, our focus here would be to make you understand, what is inside those accounting statements.

We are not here to make you, to prepare those statements. Of course, we will do it with the help of some small examples. But, our focus would be to make you understand, how a balance sheet, or how a profit and loss accounts, should be read. When we should understand, ok, this is a danger sign, this needs improvement. So, these are the things, you would like to understand, from the various accounting systems.

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### **Economic Decision Making**

- **Selection of one design out of several competing designs**
- **Selection of one construction methodology out of several construction methodologies**
- **Replacement decisions**
- **Investment decisions ? Risky investment with high returns vs safe investment with low returns**

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Now, coming back to the economic decision-making, you will find as a civil engineer, you come across many situations, wherein you have to select one design, out of many designs.

For example, you have to construct a highway from City-A to City-B. There may be different competing routes. So, A to B, I may reach it through Point C and D, or maybe, I may reach them through Point X and Y. Now, each of these routes will have different cost implications. We will try to make you understand, not only in terms of initial cost, but also in terms of life-cycle costing.


How first of all, we draw the cash flow diagram, how much money is coming, how much money is going out. We will introduce you to, the concepts of interest, and different present worth, future worth method of comparison. And then, at the end of it, we will come to know, which alternative is the most appropriate one. Likewise, another example could be, choosing one construction methodology out of several construction methodologies. Or, for that matter, we had to have, replacement analysis.

For example, today, you purchase an equipment. Now, that equipment is working fine. But, at the end of it, we need to replace it. So, when do we find, this is the right time to replace an equipment. That is part of one of the lectures, we will come across. Now, you have to understand one thing that, if you are continuing to do a thing in a particular manner, it is assumed that, you have found that to be the most economical one. So, if you are not changing anything, if you continue to do nothing, we in economic term we call this as, do nothing option.


So, if you continue to adopt to do nothing, it means, it is believed that, you have already arrived at an economic decision that, this is the best way to go. We will also like to see, various investment decisions. We will try to understand, which one out of them is the risky one, which will out of them is a non-risky one. We will try to calculate, the risk associated with each of the investment options. We will explain you, various probabilistic methods through which, you compute the risk associated with the given financial proposal.

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- Allocation of funds for few public projects out of several competing projects
- Selection of a project out of several competing projects
- Number of units to be sold for break even
  - Common things in above situations
- Each one of them involve some monetary considerations
- Generating different sets of alternatives and
- Evaluating the best out of them in a given situation

10

As it comes, in the case of public projects, as I just now told you, there may be situations in which, a large number of projects are competing against each other. So, as an engineer, government public sector engineer, you have to find out, which one is the best one. And, as I told you, here, the profit is not the main motto. But, as you know, government also does not have infinite money at its disposal. So, we need to know, how much is the benefit, and what is the cost, to put up that particular facility.

So, as long as my benefit cost ratio is in excess of one, we say okay, this project can be taken up, in further evaluation processes. Likewise, we will also take up in some lecture, the breakeven analysis. Say, for example, you have put up a batching plant. And, you find that, there are sales. So, we would like to know, how much we should produce, in order to make sure that, the company recovers the various costs, that it incurs, over a period of time. So, in the beginning, you will find that, the total cost will be much more than the revenue that it generates.

But then, for a particular volume, you will find the company would be in a position to recover all the cost, that it incurs. So, that is what we will be studying, in the case of breakeven analysis. Now, whatever situations, I have described you just now, you will find that, there are few things in common in that. First one, you will find that, each one of them involve some monetary consideration. Each one of them involve certain money.

So, whether it is replacement, whether it is equipment buying, anything whatever options I told you just now, they all involve certain amount of monetary considerations. Now, as an engineer, I also told you that, you will be told to generate a large number of alternatives. And then, based on the concepts that you will be learning in subsequent lectures, you will be in a position to evaluate each one of these alternatives, and then to come up with the best alternative. So, this is what, we will be following in a systematic manner, in the lectures to come.

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**Introduction to economic decision making**

- Stakeholders in construction projects
- Relevance of finance and accounting for civil engineers
- Time value of money, interest formulae, cash flow diagrams
- Evaluating options, payback period, NPV, IRR

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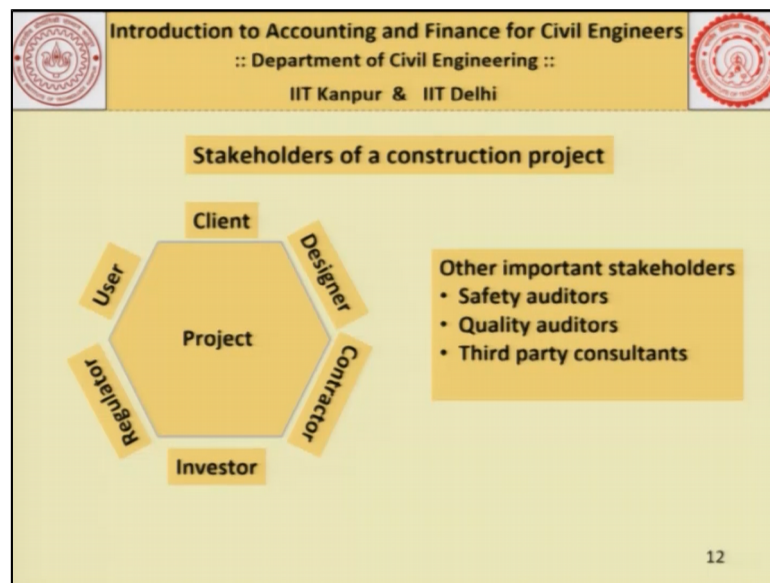
To proceed further, we will also introduce you to the various stakeholders in a construction project. Now, you will find that, construction projects have become very complex these days. There are large number of stakeholders involved. You have the financiers. You have the construction engineers. You have the contractors. Contractors also become very big in size. They can do the design. They can do the engineering. They can do the procurement and construction all on their own, or based on the support, that they receive from sub-contractors.

It involves not only civil engineering, but it involves electrical, it involves mechanical, you have instrumentation, and you have many, many areas, which are involved in modern projects. Now, in these contexts, I am considering that, there are lot of uncertainties, and the project duration are long. We need to understand, the construction accounting statements, and how to carry out the construction financing. These are very, very important, in the current context. I will also introduce you to the situation, wherein we need to consider the time value of money aspects.

You know, money loses its value, over a period of time. Not in terms of the monetary value, but the worth, it loses its value, due to many reasons. We are not going to look into, all those reasons, in this particular course. But, you will have to understand that, let us say, 100 rupees today is not exactly, 100 rupees 1 year since, or 2 years since. So, in some of the lectures, we will introduce you to the concept of time value of money, we will introduce you to the different interest formula.

And, using the cash flow diagram concept, we will be in a position to find out, the equivalence of one alternative against the other. We will also introduce you to some of the options like, payback period methods, net present value methods, internal rate of return method. These are essentially to evaluate, two alternatives at a time. So, suppose you have Alternative A and Alternative B. Which one out of them, is the best one. That is what, we are going to take up, in one of the lectures.

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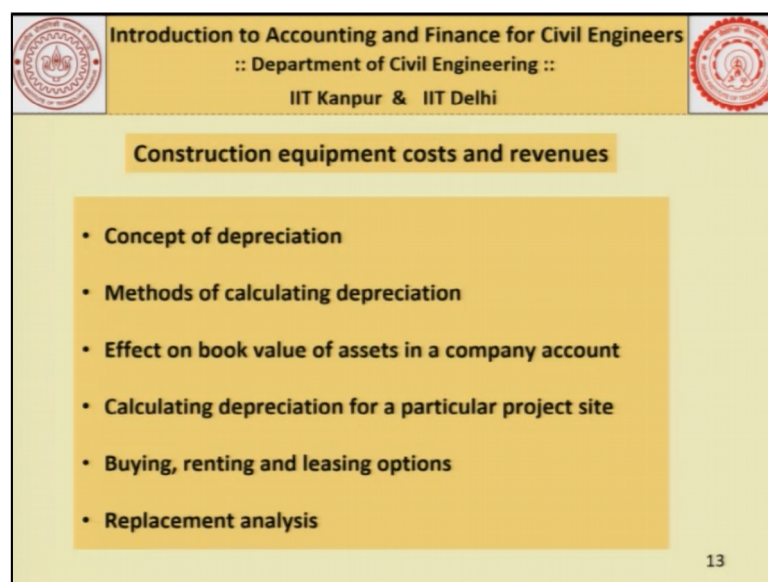
Now, when it comes to stakeholders, as I told you, modern projects involve a lot of people, a lot of companies. It could be client. It could be designers. It could be contractors. It could be investors, regulators, users. You see, there are huge number of stakeholders, that are involved in construction project. Now, if you notice, each one of these stakeholders, you will find, their objectives hardly match. So, while a client would be interested in getting his projects on time, within the budget. Contractor would be trying to earn, as much money as possible, through that particular project.

Likewise, your suppliers would be willing to supply you material, at the designated profit margin, which they have for their companies. Right. So, you find there are uncertainties, there are difference in objectives, there are conflicting objectives. Yet, in spite of all these factors, you would like your project to be completed on time, and within the budget. Now, there are different facets involved in any construction projects, in addition to your schedule and cost, you have quality parameters, you have safety, you have dispute.

Of course, not all these, we will be touching in this particular course. There are certain other specialised courses, wherein we teach all these parameters. But, in this particular course, as I told you, we will be mainly focused on the understanding of construction economics, finance, and accounting aspects. In one of the lectures, we will introduce you to the concept of depreciation. We will try to tell you, what are the different ways in which, you can calculate depreciation.

For example, you will understand, what is a straight-line method of depreciation, what is sum of years' digit method of depreciation, what is double declining method of depreciation. We will also introduce you to the concept of depreciation, in context of evaluation of different alternatives. So, we will tell you, what happens, when taxes are taken into consideration, how it changes your cash flow diagram, and then subsequently, how it changes your decision.

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**Construction equipment costs and revenues**

- Concept of depreciation
- Methods of calculating depreciation
- Effect on book value of assets in a company account
- Calculating depreciation for a particular project site
- Buying, renting and leasing options
- Replacement analysis

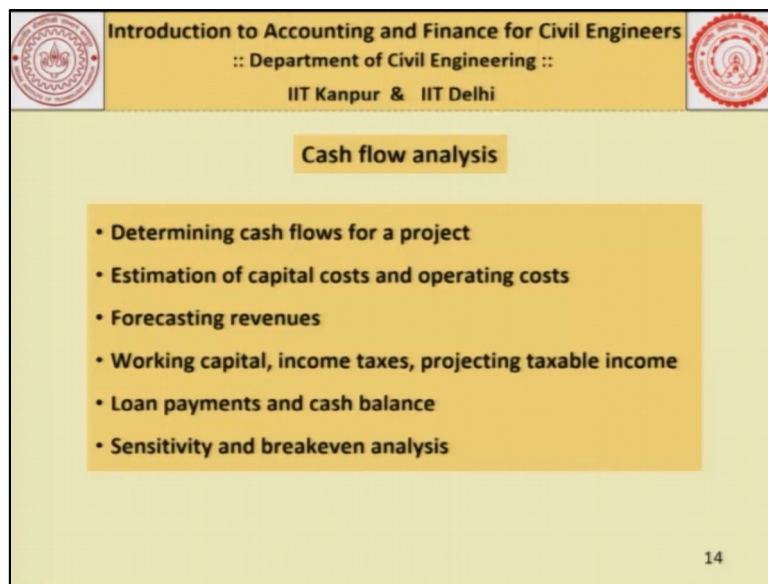
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In the context of a project, you will find, when an equipment enters the site, it comes with a particular book value. Then, during its uses, its book value depreciates. So, we will tell you, how to calculate the depreciation for those equipment's, which are commonly used in the

context of a construction project. We will also introduce you to the concept of buying versus leasing, then renting versus owning.

These are the concepts, that we will be discussing in one of the lectures. And, as I told you, we will also introduce you to the concept of replacement analysis, wherein you will come to know, what is the right time to replace an equipment. This is based on the total cost, which includes the purchase cost, the operation and maintenance costs, the scrap value, and so on.

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**Cash flow analysis**

- Determining cash flows for a project
- Estimation of capital costs and operating costs
- Forecasting revenues
- Working capital, income taxes, projecting taxable income
- Loan payments and cash balance
- Sensitivity and breakeven analysis

14

We will tell you, how to calculate the project cash flow diagram. You will find that, project cash flow diagrams are slightly different than, the normal cash flow diagrams. Because, in order to draw project cash flow diagrams, you have to refer to different documents. For example, you have to refer to bill of quantity, you have to refer to the contract document, you have to know the schedule of the project. And, in addition, you must also know, what are the key financial conditions involved in that particular project.

This will enable you to know, at what point of time, you will receive the money, and at what point of time, you will have to spend the money. We will discuss, capital costs, and operating costs, in context of acquiring assets. We will also let you know, how to calculate revenues, depending on the stage at which, a project is. We will discuss, what is working capital, what are the sources to mobilise working capitals. And, we will also discuss, key features pertaining to sensitivity, and breakeven analysis.

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**Economic analysis in the public sector**

- Objectives of projects
- Benefit-cost ratio
- Incremental benefit-cost analysis
- Incremental rate of return method
- Capital rationing

15

In the context of public sector projects, we will introduce you to the concept of benefit cost ratio, wherein we will try to calculate, the benefit to the public, and cost to the government. This evaluation, we will carry out for two alternatives at a time, and then subsequently for more than two alternatives. Now, whenever you have got more than two alternatives, we do not do the conventional methods of, net present worth, or future worth, or annual cost and worth method, or rather internal rate of return method.

We will use, the concept of incremental analysis. So, it could be either incremental rate of return method of analysis, or it could be incremental present worth, or incremental future worth. We will also discuss, the concept of capital rationing. When the capital is scarce, and you have large number of competing projects, how to select a project from the limited fund. That is what, will be the objective of this particular lecture. Then, as I told you, our focus would be to explain you, the different nuances of construction accounting.

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**Basic terminology of accounting**

- Assets and liabilities; debit and credit, profit and loss
- Revenues and expenses
- Books of accounts
- Accrual accounting
- Cash-flow statements,
- Working capital,
- Bankruptcy and risk,
- Financial instruments
- Profits and taxation – pretax and post tax profit,
- Equity capital and debt capital,

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In that, we will come across different key terms like, the assets, and the liabilities. Under assets, we will see, what is a fixed asset, what is current asset. Likewise, in liability also, we will see long-term liability, short term liability. You will understand, what is debit, what is credit. We will also try to explain you, the profit and loss statement, for a given period, for a particular company.

We will see, what are the different avenues for revenues. And, what are the expenses, that a particular company incurs, on a day-to-day basis. Then, we will try to explain you, the concepts of working capital, equity capital, debt capital, and so on.

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**Financial accounting systems**

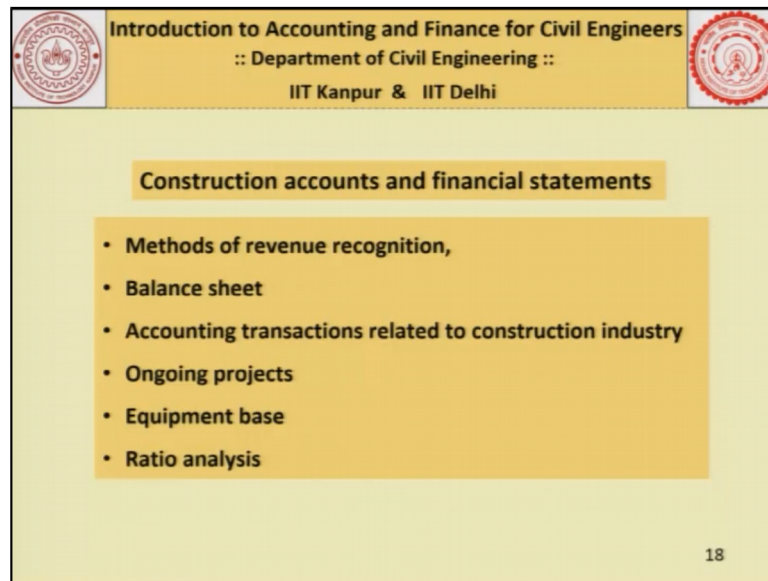
- Various forms of businesses,
- Role of financial manager,
- Generally Accepted Accounting Principles (GAAP),
- Concept of bookkeeping, types of book-keeping (single and double entry),
- Journals and ledgers
- Accounting process, trial balance and accounting cycle

17

We will also try to explain you briefly, the different forms of businesses, the role of financial managers, what are the key accepted principles of accounting, the concepts of bookkeeping,

the term journals, ledgers, the trial balance, the accounting cycle. All these, we will be covering in our subsequent lectures.

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The slide features a yellow header with the text "Introduction to Accounting and Finance for Civil Engineers" and "Department of Civil Engineering :: IIT Kanpur & IIT Delhi". Below the header, a central box contains the title "Construction accounts and financial statements" and a bulleted list of topics: "Methods of revenue recognition", "Balance sheet", "Accounting transactions related to construction industry", "Ongoing projects", "Equipment base", and "Ratio analysis". The slide number "18" is located in the bottom right corner.

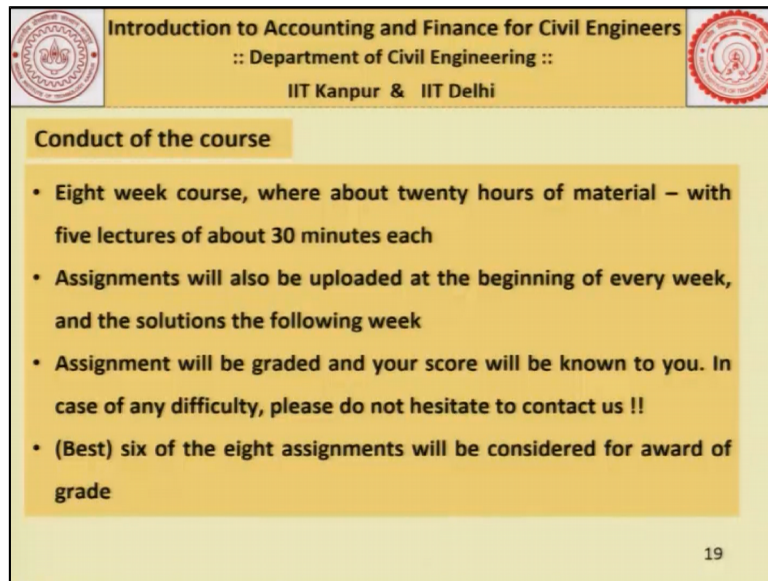
Then, one important aspect, that we will be covering in construction accounting would be to understand, how to recognise revenue. There are different ways to recognise revenue, for a construction project. We will see, all of them. We will explain you, each and every term, that are involved in a balance sheet, for that matter, profit and loss accounts. We will also explain you, what are the key parameters to look into, to understand the health status of a particular organisation.

We will also introduce you to various financial ratios, which indicate the short-term soundness of the company, or the long-term soundness of the company. So, we will explain you, different types of ratios as well. Now, as far as the conduct of this particular course is concerned, I will request Professor Misra to outline the total syllabus, and basically the plan of the particular course. How to go about it. From here onwards, Professor Misra. Please.

Many thanks, Professor Jha. I am sure you understand that, we have a fairly packed program in the next couple of weeks, when we will go through a lot of jargon. We try to make it as simple as we can, so that as engineers, you are able to understand, financial statements. Now, as far as the conduct of this course is concerned, we will largely follow the guidelines of NPTEL and MOOCs. This particular one is an 8-week course.

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**Conduct of the course**


- Eight week course, where about twenty hours of material – with five lectures of about 30 minutes each
- Assignments will also be uploaded at the beginning of every week, and the solutions the following week
- Assignment will be graded and your score will be known to you. In case of any difficulty, please do not hesitate to contact us !!
- (Best) six of the eight assignments will be considered for award of grade

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Where about 20 hours of material, with 5 lectures of about half an hour each, will be uploaded every week. Assignments will also be uploaded at beginning of every week. And, the solutions, the following week. These assignments will be graded, and your score will be known to you. In case of any difficulty. For example, you may say that, I marked the question right, my answer was right, it matches with the key that was given, but it has been graded wrong, I have not been given credit for it. Those kind of difficulties may arise, sometimes. And, for that, you please feel free to contact us.

There will be a forum, which will be managed by the teaching assistants with us. And, I can only assure you that, all your queries and comments will be addressed, not necessarily very expeditiously, but we will try to be as prompt as possible. Please also understand, that out of the 8 assignments that we will be giving, in this 8-week course, best 6 will be taken for the award of the grade. That is, we will take the best 6, and use those, to compute the final grade. As far as the final grade is concerned, there is the option of an examination and certification, which some of you may take, may not take.

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**Introduction to Accounting and Finance for Civil Engineers**  
:: Department of Civil Engineering ::  
IIT Kanpur & IIT Delhi



**Final examination and certification (Optional)**

- There will be a final online examination at the end of the course, which will be for three hours and cover the entire course.
- Apart from 'new questions', the final examination will also contain some questions from the assignments !!
- A final assessment of performance will be done by assigning 25% to the home assignments and 75% to the final examination
- Based on the final performance, a certificate will be given to those who pass the course.

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There will be probably a fees associated with it. Now, as far as the exam and certification part is concerned with that fees, there will be one final online exam at the end of the course, which will be for 3 hours. And, it will cover the material, that has been covered for the entire course. Apart from new questions, the final exam will also contain some questions from the assignments. So, my submission to you, very strongly I would recommend that, please do the assignments seriously on your own, and try to understand the principles that are involved.

If you do not understand a particular question, there is always the discussion forum, which you can use to reach us, to resolve the problem among yourselves, and so on. Of course be, certain new questions, which you probably would not have seen. And, they will be part of the final exam. The final assessment of performance will be done, by assigning 25% of weightage to the home assignments, that is, the best 6 out of the 8 as I mentioned, and 75% on the final examination.

Based on this final performance, a certificate will be given to those, who passed this course. Now, with that background, as we go along at the end of each lecture, or in the module, or through the discussion forum, I will try to help you, with providing the kind of reference material that you may use, to gain more insight into the subjects that have been covered.

As Professor Jha has also categorically stated, the objective of this course, is not to make accountants out of civil engineers. But, it is only to expose the civil engineers, or for that matter any other engineer, to the kind of nuances of finance and accounts, which is very, very

important in the modern day. With this, we come to an end of the discussion in the first lecture. And, I look forward to seeing you in the next one. Thank you.