Design of Steel Structures
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Module – 1
Introduction
Lecture - 1
Introduction to Design of Steel Structures

Hello, today I am going to start the course on design of steel structure. Before going to introduce first I will discuss about the syllabus then some useful books and references. Then some terminology which we used in case of steel design and then some steel properties advantages disadvantages of steel structure how we will do. Then lecture wise means module wise lecture contents. So, all these things I will discuss in today's lecture.

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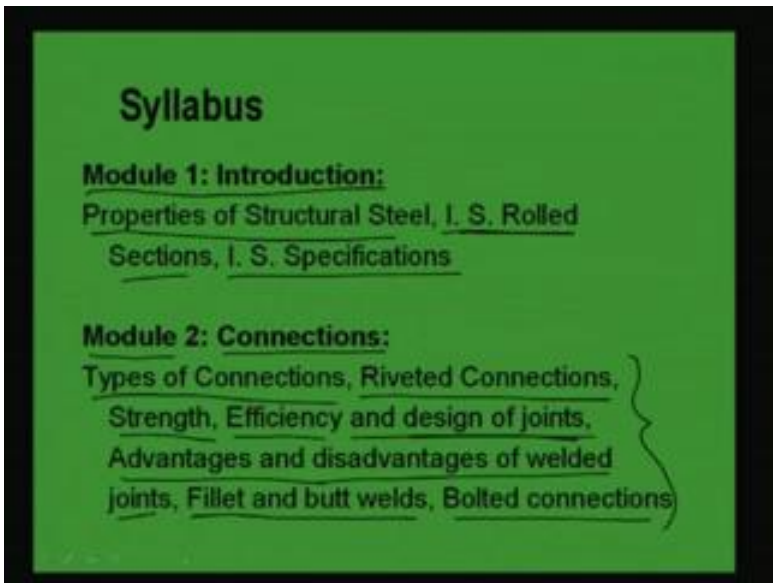

Module wise syllabus I have made in this way. First module will be on introduction which I am going to cover today, which will consist of properties of structural steel, IS rolled section means Indian standard role sections IS specifications. Now, in module 2 I will cover on connections. Connection mean connections between 2 members like say beam and column when a load is coming from beam to column it will come through means the load will pass through that connection. So, connection should be designed in such way that the load is passing without failure. So, connection is an important aspect

on design of steel structure. In a industrial building or in a steel structure building steel structure like bridge structure.

We know different elements are there different member are there like beam, column, strut splices, then column bases, like base, plate gusset, base right girder many things are there many members are there. But all these are connected one with another by some connections, so before going to design element level means member level design. Let us first know about the details of the connections. So, that when we will be going to design of a beam or say column, how to design the connections also for that beam that also we will also be able to know if we cover this first. That is why I am covering this module first. This module content of set types of connections. Types of connections mean we known riveted connection bolted connection and welded connections are there those connections.

Then we will discuss about the riveted connections, then strength, strength of the riveted connections. How to calculate the strength? How to calculate the efficiency and how to design a joint with riveted? So, with rivet how to design joint those things we will discuss. Then we will go to advantages and disadvantages of welded joints what are the advantages and what are the disadvantages of welded joints those things we will discuss. Again weld means 2 type of weld design we will use 1 fillet weld another is butt weld and then we will discuss about the bolted connections. So, broadly these things we will discuss on module 2 in several lectures we will make. Now, these are approximate. In fact, some more or less means we will be going to add with this. So, I am not giving the exact 1 whatever I will be giving delivering the lecture, but a broad background I am giving.

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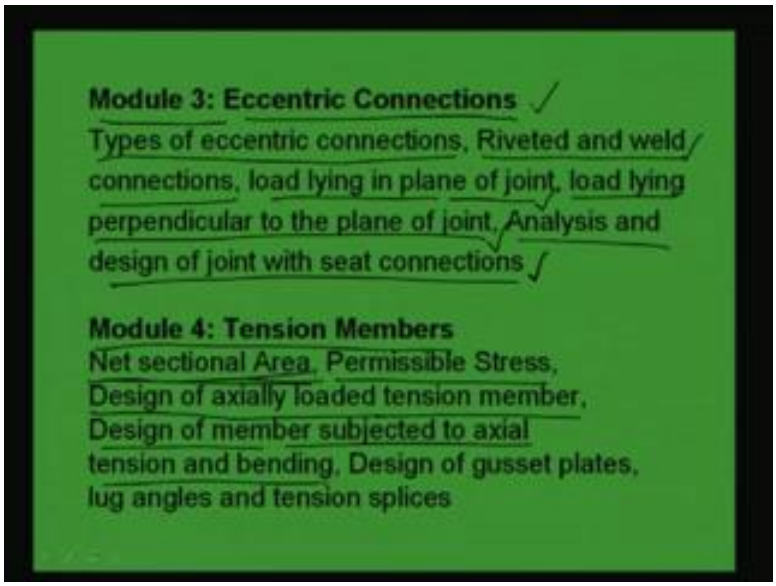

In module 3 I will discuss about eccentric connections. Eccentric connections means in module 2 the connections which are concentric means directly say 2 members are there directly when we are going to join. So, tension member or compression member those things, but when load lying on the plane of the joint means when eccentricity will come into picture then how to design. How to analyze the joint? So, with some assumptions with some simplified assumptions we use to design those things through these eccentric connections. So, there we will discuss about say type of eccentric connections then riveted and weld connections then load lying in plane of joint, load lying perpendicular to the plane of joint. Then analysis and design of joint with seat connections with seat with bracket how connections are made those things also we will discuss.

So, in eccentric connection I am repeating once again that we will discuss about types of eccentric connections. Then rivet and weld connections then for rivet and weld connection we will first load lying in plane of joint when load is lying in plane of joint and when load is lying perpendicular to the plane of joint. So, in both the cases we will see how the connections are going to made by the use of weld by the use of rivet. Then analysis and design of joint with seat connections with the use of seat connection how to design a joint that also we will see this is the module 3. In module 4 we will come to the design of some member. This is first we will start with tension member. Tension members means when the members are under tension only. So, there will cover say net

sectional area why net sectional area will come, because of rivet hold etcetera the area which will be going to reduce.

So, we have to find out the net sectional area which will be less than the gross area then permissible stress how to find out permissible stress for different cases then design of axially loaded tension member. Design of member subjected to axial tension and bending that means first we will discuss about the design of axially loaded tension member. Then means only axial load is there then axial load along with bending. Then how design we will be changing that we will show. And to discuss all these again we will discuss about design of gusset plates, lug angles and tension splices which would be required for design of tension members. These are some additional members which would be required for making joint. So, design of gusset plates lug angles and tension splices. So, those things also we will discuss we will cover in this module 4.

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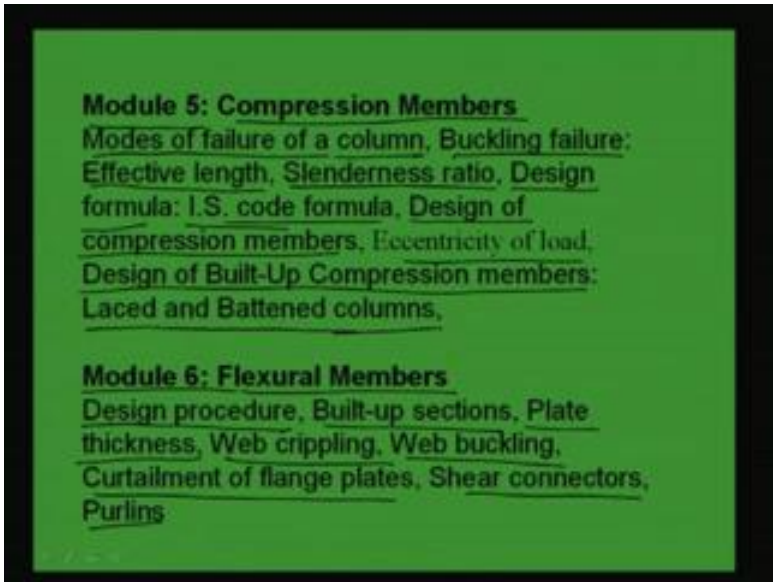

In module 5, we will discuss on compression member. Compression member means basically we use to tell say column. So, we will see modes of failure of a column means compression member. Buckling failure, then effective length how to find out effective length of a column? A slenderness ratio slenderness ratio we will find out then design formula using IS code formula means design formula what IS code has specified those things we will see. Then design of compression member then eccentricity of load. If eccentricity of load comes into picture then we know that additional load will come due

to eccentricity means in terms of moment. So, that also has to be taken care. Then design of built-up compression members. Built-up compression members means when a single member single role section member is not sufficient to carry the whole compression load.

Then we may have to go for built-up sections. As per the requirement of the hum member we may have to design the member in terms of built-up members means we will show later that a combination of 2 or more members 2 or more rolled section or some other type of plate section also. Then we will discuss about laced and battened columns mean when columns are built-up then we have to tie those through lacing or battening system. So, how to lacing has to be designed in what way lacing parameters will be decided in what way battening parameters will be decided? Those things we will discuss. So, in compression member we will discuss mainly on mode of failure of a column, then buckling failure, effective length, slenderness ratio, design formula, IS code formula, design of compression member, eccentricity of load, design of built-up compression member and lacing and battening of columns.

So, those things we will discuss. In module 6 we will discuss about flexural members. Flexural members means beam; that means, when the flexural action will come into picture. As we know when member is under the transverse load then bending moment will develop. So, because of bending moment bending stress will develop. So, how to design against this bending stresses that we have to see which this bending stress in which member is developing is? This is generally called beam member or flexural member. So, we will discuss about the design procedure. And also we will discuss how to find out the allowable bending stress in compression and in tension? Those things which will include in design procedure. Then built-up sections then plate thickness how to decide web crippling web buckling curtailment of flange plates shear connector's purlins.

So, all those aspects will be discussing in flexural members. I am repeating once again that design procedure of flexural member which will include that how to calculate the allowable stress in bending, in compression and in tension? Then built-up section when the single role section is not able to carry to the load or when the span is very then we use to go for built-up sections. So, how to choose the built-up section? What way we will decide all these things? We will discuss there. Then plate thickness how to find out

means additional plate thickness on the built-up members that we will be discussing. Generally the, I section is the most efficient section for carrying bending moment for beam we generally use I section.

So, when I section is not sufficient. So, if the highest I section is not sufficient then we use to provide plate in the flange additionally. So, that plate thickness and other details will be decided and those things we will discuss. Then web crippling web buckling those things we will discuss. Then curtailment of flange plates curtailment of flange plates, because the, we will see because the moment is varying throughout the span of the beam. So, we generally use to design the member in terms of maximum moment, but that maximum moment is generally happens in the mid span and other places this moment is going to reduce.

So, there we do not need that much heavier section. So, we can reduce the section by the use of curtailment of plates. The plate's additional plate whatever we were using in the mid span where the maximum moment is developing that we can reduce step by step towards the support. If the support is simply supported; that means, moment is going to 0 at this simply support at end. So, those things how to find out all these things we will discuss in the in this module. Then shear connectors and another important aspect which we will discuss and purlin etcetera which we used in this set industrial set. So, those things also we will discuss where unsymmetrical bending will come into picture those things we will little we will discuss there.

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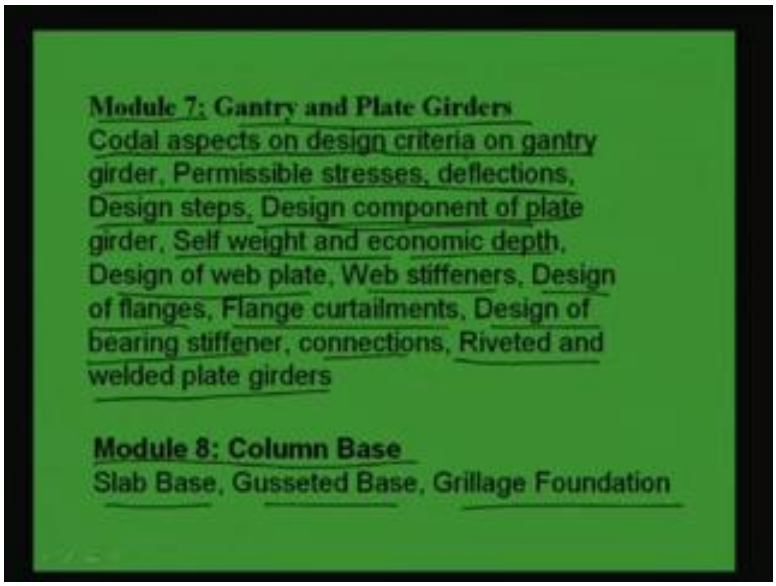

Then we will go to module 7 where the gantry girder and plate girder will be covered. As we know girder means it is a type of beam. Girder itself is a beam. So, gantry girder and plate girder is nothing, but a beam. So, we could include module 6, but we have intentionally kept in separate model thinking that, because gantry girder is a huge things means many things has to be taken means known. Again plate girder is a separate chapter which we need lot of discussions. So, here I will give just some introduction to gantry girder and plate girder. In gantry girder generally I will try to finish by 2 lectures. In 1 lecture the design procedure in another lecture the workout example through which a gantry girder can be designed.

But many other aspects in many case to case for moving load, because gantry girder where we use we know in industrial building where the moving load means has to be lifted. Some load has to be lifted from one place to other places through trolley or crap that means load is going to move from one to another place. So there, how to calculate the maximum bending moment and maximum shear force? Then how to design those things? We will discuss. So, in fact, there are some codal aspects on design of gantry girder is also there those things. Also we will discuss like maximum deflection permissible stresses all these things has been given in the code those things face to face we will discuss.

So, in gantry girder we will discuss codal aspects on design criteria on gantry girder then permissible stresses then deflections then design steps then design component of plate girder. So, after this we will discuss about the design component of plate girder. Plate girder consisting of several components like web flange then stiffness, so flange plates many things are there connections. So, all the design components we will discuss and during that plate girder discussion we will include the sulphite and economic depth. How to calculate for a plate girder? That we will discuss sulphite and economic depth then design of web plate, web stiffness, design of flanges, flange curtailments, design of bearing stiffness, connections. All these things we will cover and as we know plate girder means again riveted plate girder and welded plate girder; 2 type of plate girder we use in practice, 1 riveted plate girder another is welded plate girder.

So, in both cases design will be means to some extent similarity is there again many differences are also there. In terms of connections in terms of finding the minimum depth means economic depth all these things are some differences there. So, we will discuss for riveted connection means riveted plate girder as well as for welded plate girder, but with very shortly means may be we will cover in 3 lectures. One lecture; we will be giving on design of riveted plate girder design aspect of riveted plate girders. Another lecture on design aspect of welded plate girders and another lecture maybe we can go through an workout example of 8 riveted or welded plate girders. So, that we have some idea then the last module will consist of column base that is module 8 which will include slab base, gusseted base and grillage foundation. Column base means the loads which are coming from the superstructure and coming through column has to disperse to the soil properly.

So, the concentrated load coming from column has to be dispersed in some way which we use to do through some plate which is called base plate that is steel plate. First we provide some steel plate to disperse the load from column to the steel. Then again we provide some concrete slab concrete block to disperse load again from steel plate to the concrete block and then to soil. So, on the basis of type of soil, and on the magnitude of the load and the type of load, whether only, eccentric means only concentric load or axial load or along with some eccentricity or some moment. So, on that basis we may have means we have to decide whether we will go for slab base or gusseted base or grillage foundation. So, in which cases which is required all these things will be learning through this module. So, these are the some module means approximate approximately I have

divided to such modules. So, there will be 8 modules and 8 modules 40 lectures will be delivering to cover whole things.

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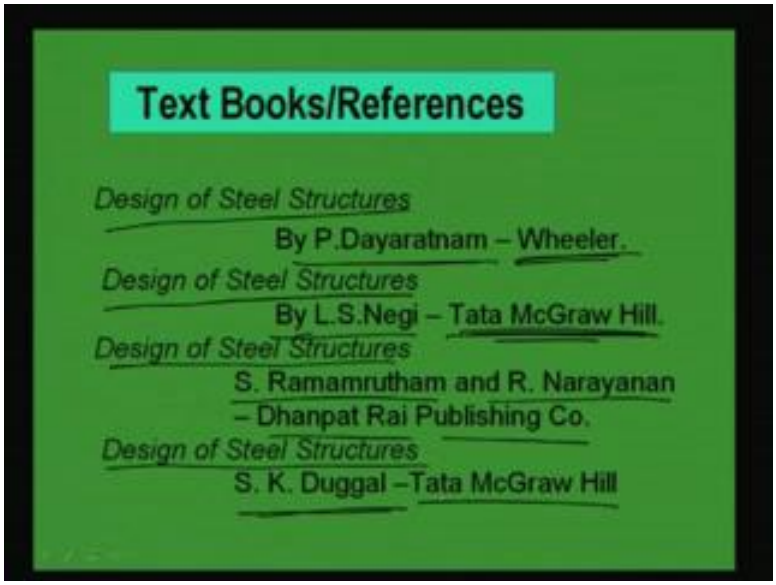

Now, as we know the lecture is not sufficient we have to go through some books and references and of course, web courses means web. In web also the lecture material will be given through that also you can know. So, the books which I will suggest is in fact, you can you can follow any book, but what I have followed I can give the name that is design of steel structure by Dayaratnam P Dayaratnam. So, this is one book which is very good and handy which you can follow design of steel structure by P Dayaratnam Another book is design of steel structures by L S Negi. It is very effective book and the numbers of pages are very less in that book, but very informative and very effective I should say that efficiently it has been written. So, you can follow this also. Another book design of steel structures by S Ramamrutham and R Narayanan this is Dhanpat Rai publishing company.

So, design of steel structure by Ramamrutham and Narayanan. Publishing company is Dhanpat Rai Dhanpat Rai publishing company. This is also a good book and in fact, lot of examples has been given and very details it has been written. So, one can use this book also. And L S Negi the design of steel structures by L S Negi that was published by Tata McGraw Hill all remember Tata McGraw Hill and design of steel structure by Dayaratnam that is published by Wheeler. Another good book is that design of steel

structure by S K Duggal which is also written in a very systematic way in step by step design procedures have been given which one can follow very easily that is published by Tata McGraw Hill. The book is written by S K Duggal Design of steel structure by S K Duggal by Tata McGraw Hill.

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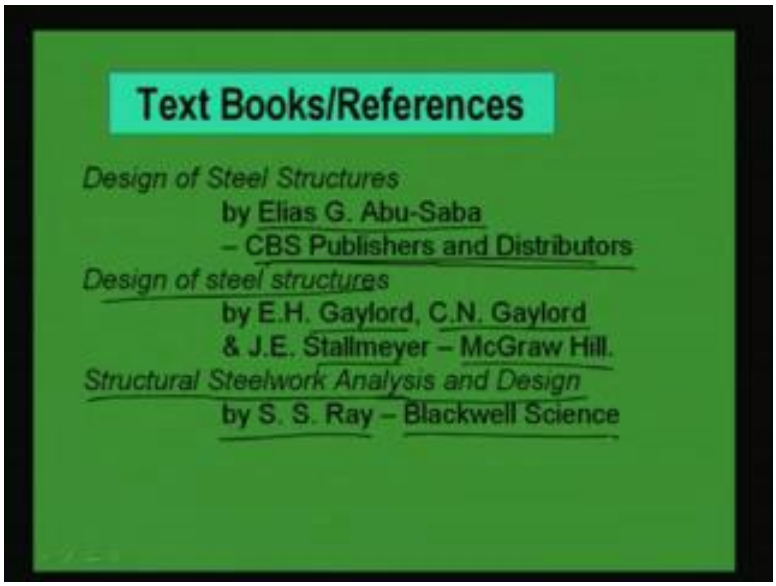

Other books also you can follow like design of steel structure by Elias G Abu-Saba CBS publishers and distributors. So, this is also one another book which one can follow. Another book is design of steel structure by E H Gaylord and C N Gaylord J E stallmeyer by McGraw Hill. So, this book also one may follow. Another book which is also very good means very complicated means what you say means nicely it has been written. And very detailed things are given particularly in connection etcetera it has been given very nicely by S S Ray. That is Blackwell Science this book also one can follow but I will suggest this means this 4 book as a textbook. Anyone of the book can be used as a textbook means you can use any of any of these 4 and these are the some references which also you can use for your knowledge.

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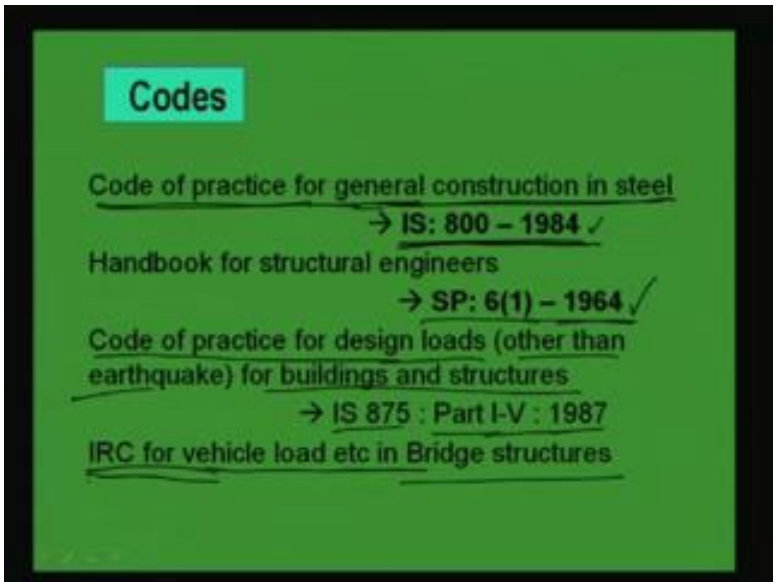

Now, the codes code means as we know from next lecture you need to follow code. So, please purchase code have code IS code before going to listening second lecture, because without codal provision means without code you may not be able to follow. This is must this code that is IS 800 1894 which will be the main code that is code of practice for general construction in steel IS 800 1984. So, here this is the main code which we use to follow that is design practice for general construction in steel. Number; we use to follow a like this IS 800 1984. This book is means this code is must, another code is must that is this one. The handbook for structural engineers SP 6 by 1964 here the steel property of rolled section has been given. So, all the properties of the steel rolled section has been given which can be found from this handbook SP 6 by 1964.

Other code which we will be required will be that code of practice for design loads other than earthquake for buildings and structure that is IS 875 part 1 to part 5 1987. These codes will be required to calculate the load different type of load like dead load. How to calculate dead load? What are the specifications? What is the density of different type of material? So, in part 1 it is given part 2 consist of live load. The different type of live load what will be the live load at the terrace? What will be the live load at the mid floor? What will be the live load in residential building and in commercial building? So, those things has been defined IS 875 part 2. Similarly, in part 3 with wind load has been defined right. How wind load is going to be calculated and in what city of our country? What will be the basic wind speed? All these things have been defined in this code. So,

code IS 8 7 5 part 1 to 5 1987 is basically required for calculation of the load which will be coming to the structure.

Then IRC code some Indian road congress code will be required for vehicle load calculation this is mainly required for bridge structures. Sometimes when we will be going for gantry girder design the moving load is coming into picture. So, there we may need this code codal reference, so and in case of plate girders also plate girder. As we know plate girder is generally used for long span when the span of the beam becomes more than 18 or 20 meter in that cases and when the load is very high. Then we use for plate girder and this is generally used for bridge structures. So, there is some codal provisions are there in Indian road congress code. So, those things with be required. However, I will suggest these 2 code immediately you should have for following my lectures that is code of practice for general construction in steel IS 800 1984 and handbook for structure engineers SP 6 1964.

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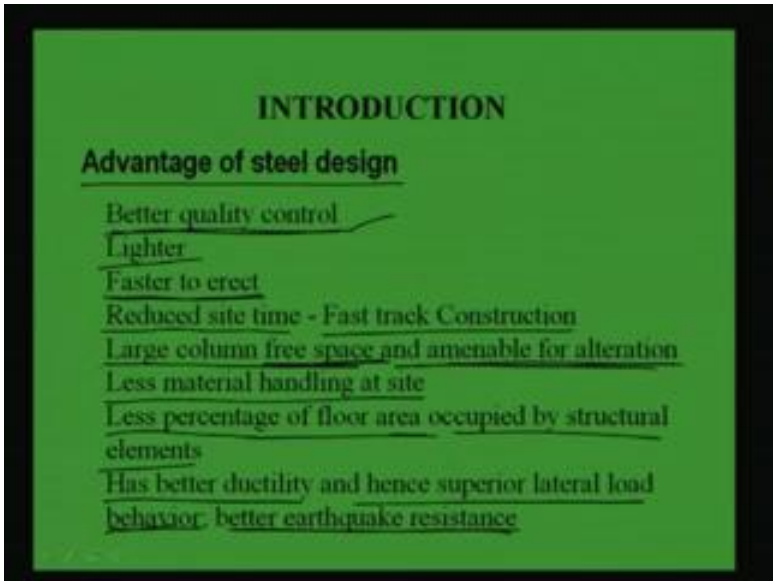

Now, very shortly I will just discuss few things like say what is the advantage of steel design why we are going for steel design why not the RCC design? Of course both the design we have to know RCC and steel design both the design has their own advantages and disadvantages. So, when we are going to adopt some design when we are going to follow some design when we are going to built construct some structure. We must know whether we will go for steel or concrete or steel concrete composite. So, we must know

what are the advantages and disadvantages. So, that the designer can choose, so that we can choose which one will be the preferable for us. So, what are the advantages just salient points I am giving one is better quality control.

In case of RCC structure quality control may not be able to maintain up to our expectation, because concrete mix has to be done properly. Here the here as the, we do not need we can just simply purchase the particular grade of steel and we can use. So, we do not need to be worry about those. So, this better quality control can be made in the production, so that can be a good advantage for steel design means steel welding another is it is very light. It is light compare to concrete structures. So, dead load of the structure of the self-w8 whatever we call of the structure will be the lighter. Another is faster to erect we do not need to wait for curing of the concrete and for settling of the concrete cement. So, we can just simply erect. It is faster to erect Then reduced site time fast track construction if we want to reduce the time for construction then we can go for steel design a large column free space and amenable for alternation.

Now, as these are means as steel as very strong in nature and ductile, so generally column area becomes less. So, we will get free space column free space means in case of concrete building we will get it means a huge column area. So, we can mean we can make use of these free spaces and also we can go for some alternation less material handling at site. That is also another advantages less percentage of floor area occupied by structural elements, because of lesser section required for the steel structure we need less percentage of floor area occupied by the steel elements. It has better ductility and hence superior lateral load behavior thus better earthquake resistance. As the steel has better ductility compare to concrete and other material that is why we can say that it is a super superior lateral load behavior means lateral load behavior will be better and it will be a better earthquake resistance. So, in case of earthquake upon area we may think such type of building.

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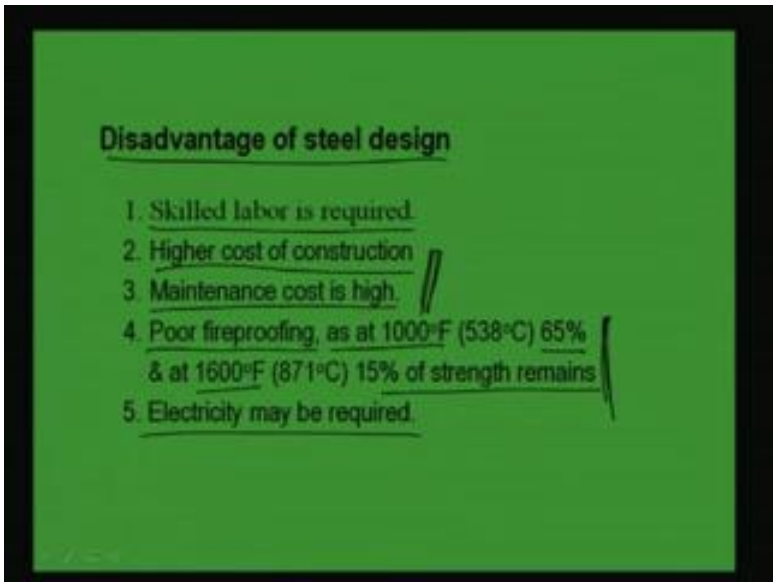

Now, what are the disadvantages? Seeing the advantages one can say then we can go for the steel building, but why we are not going? Many things are there the major thing is higher cost of construction, because this cost very high. This is the major thing. Another thing skilled labor is required we need skilled labor to erect and to make property to make the joint properly to make the structure erect properly. So, we need skilled labor. Then maintenance cost is high right, maintenance cost would be quite high, because of pollution and other things. Poor fireproofing as at 1000 degree Fahrenheit 65 percent and at 1600 degree Fahrenheit 15 percent of strength remains. So, this is another from fire to pin point of view this is a big disadvantages. And electricity may be required sometimes to make the joint etcetera for welding joint, etcetera.

So, that is, but majorly we should say that these 2 high cost of construction and maintenance cost is high. So, from economy point of view we may not be able to means judge if we go for steel building, but then should we not go for steel building? Yes it depends. A, what type of building we are going to do? And if we need more column area means column free area if we need more area and without column then in that case we should go like in industrial building and if it is a tall building. Then we will see concrete for its own sulphite the area of column will become very high. So, we may not be able to go for high I mean high hierarchy building. So, in that case steel building will be required means steel structure will be required. So, we have to see both the cases and we have to optimize which will be better.

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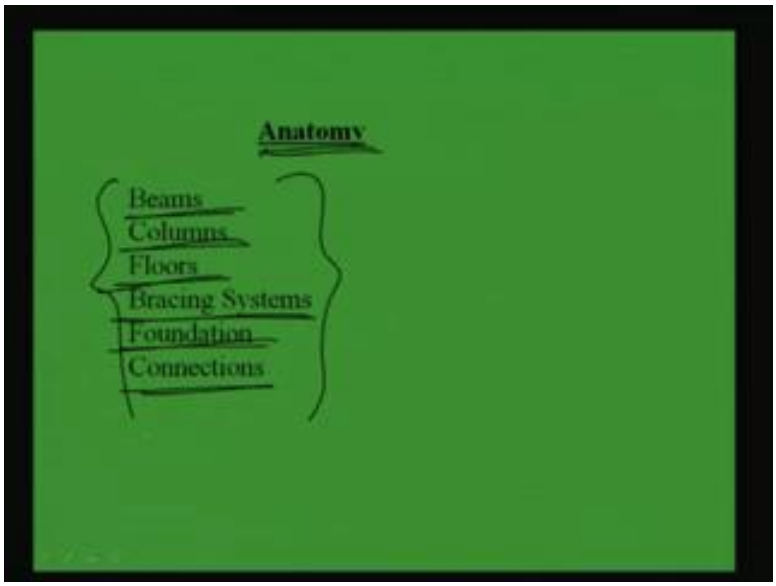

Now, anatomy means anatomy means what is the anatomy of a steel structure? There we will see one is called beam. Beam will come into picture then column then another is floor. Bracing system, which is very important for hierarchy cases and then foundation and connections. So, these are the anatomy of a steel building beams columns floors bracing systems and foundation.

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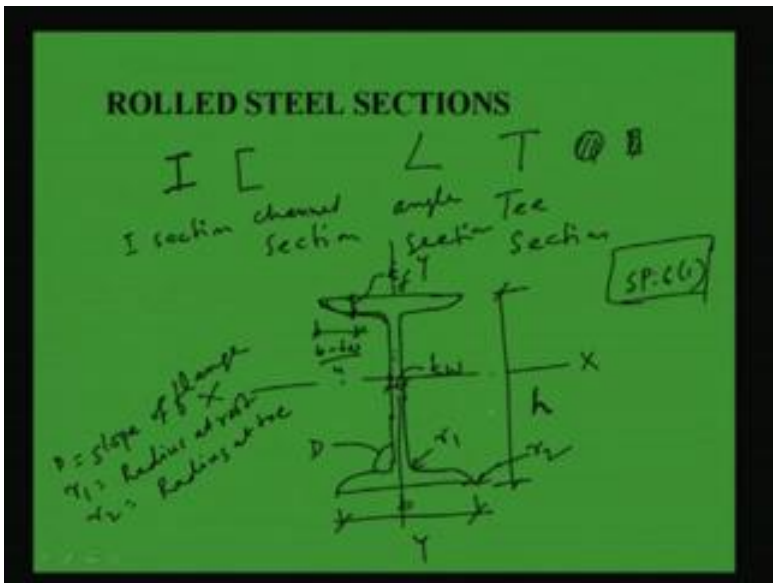

Now, let us discuss some rolled section. Rolled section means say I will come into details say one is say I section which is generally used for beam member means for beam

flexural action we use for I section. Another is called channel section, so this is called I section. This is called channel section and this is called angle section. I will come details this is called Tee section. And then may be some circle around steel bar or with some rectangular steel plate these also we use to make. So, this is solid. So, first let us discuss about the, I sections. I section means how does it look and what are the things we have? Let us discuss.

First let us draw the section how it looks? This total depth for the I section is denoted in the code. Code means always SP 6 1 that handbook structure handbook this is called depth of the section edge. This is denoted by edge and width of the flange is denoted by b and this is called web thickness of web is denoted by tw. Another thing is thickness of flange this is written as tf and this is the x x direction and this is y direction. And this tf as you see this thickness of flange is varying from here to here it is varying. So, where we will measure? This is measured at a distance of b minus tw by 4 b minus tw by 4 all these things you will get details in SP 6 1.

So, at this, b minus tw by 4, where b is the width of the flange and tw is the width of the web. So, b minus tw 4 at a distance of b minus tw by 4 from end of the flange the thickness whatever will come is called tf thickness of flange. And this is the slope of flange this is termed as D. D is nothing but the slope of flange and this is called r 1 radius at root r 1 is nothing but radius at root and this is r 2 radius at 2 r 2. So, these are the standard things which are given in the SP 6 code. So, we have to know what are the terms and accordingly the specification has been given the value has been given. Now, let us see how the terms are coming?

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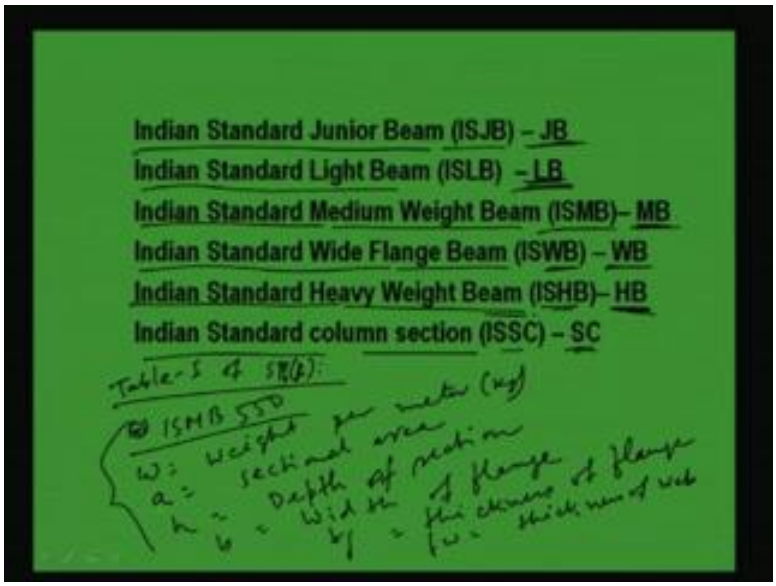

Like we use to say ISJB or JB what is this. This is called Indian Standard Junior Beam. Indian Standard Junior Beam is denoted by ISJB. Similarly, Indian Standard Light Beam that is denote by LB ISLB or LB. Similarly, Indian Standard Medium Weight Beam ISMB. So, different type of I section beam means I section is available. And mainly these are used for beam that is why name has been in this way a MB medium weight beam. LB light beam, JB junior beam, Indian Standard Wide Flange Beam Weight Wide Flange Beam, Indian Standard Heavy Weight Beam HB ISHB or HB. Indian Standard column section ISSC or SC like this we use to use. Now, in table 1 of SP 6 SP 61 there it has given you will see what are the things are given in table first is given the weight.

Suppose, I am telling say ISMB 550 then ISMB 550 in table 1 corresponding to ISMB 550 you will get several parameters details like first you will get w which is weight per meter in kg. So, ISMB 550 when we are telling we know what is the weight of the beam that is weight per meter in kg. Then you will get a; A is the sectional area what is the area of the cross section of this ISMB 550? That is also given their sectional area then h that is depth of section. So, in case of ISMB 550 h will be 550 millimeter H then b width of flange, then tf thickness of flange then tw thickness of web. So, in this way all the details will be given their apart from this. So, what are the things has been given weight area hb tf tw. Hb tf tw means tw is this, Tw h is this 1 the depth, B is the width of flange, and Tf is the thickness of flange that is given. So, all these things are given along with this D r 1 r 2 those things also are given.

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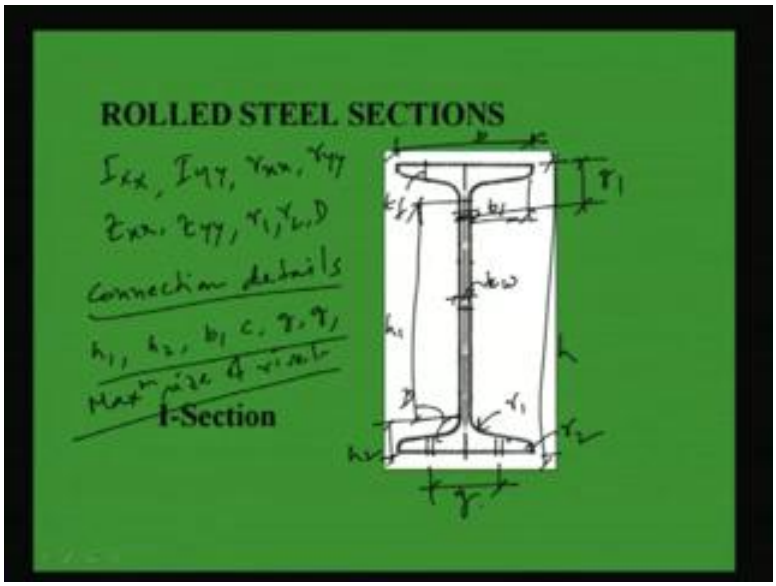

So, like Ixx what is the Ixx value Iyy value then rxx radius of gyration about x direction radius of gyration about y direction then section modulus zxx? Section modulus in y direction then r 1 r 2 d. R 1 r 2 as we know r 1 is the radius in root and r 2 is the radius at 2 and d is the slope. Then, so these are the things we will be getting other things as I told this will be b this will be h, this will be tw, this will be tf. So, all these things are given along with these, other things we will get that is connection details, because as it is a rolled section. So, some standard things are there which is given. So, through that we have to calculate.

And these are all standard say for ISMB 550 the value has been given like h 1 you will see in connection detail h 1 h 2 I am coming which one is which one, then b 1 c, g, g 1 right and also maximum size of rivet. So, all these you will get in a tabular form what is h 1 and h 2? This will be the h 2 and this will be the h 1 and what is b 1? B 1 is from here to this. This is b 1 and g is here you will get some rivet hole for riveting etcetera. So, this is the gauge distance g then g 1 here also you will get some for connection, so this is called g 1. So, in this way we can find out all the details. So, if you go through the code you will understand in details. Similarly, for say channel section.

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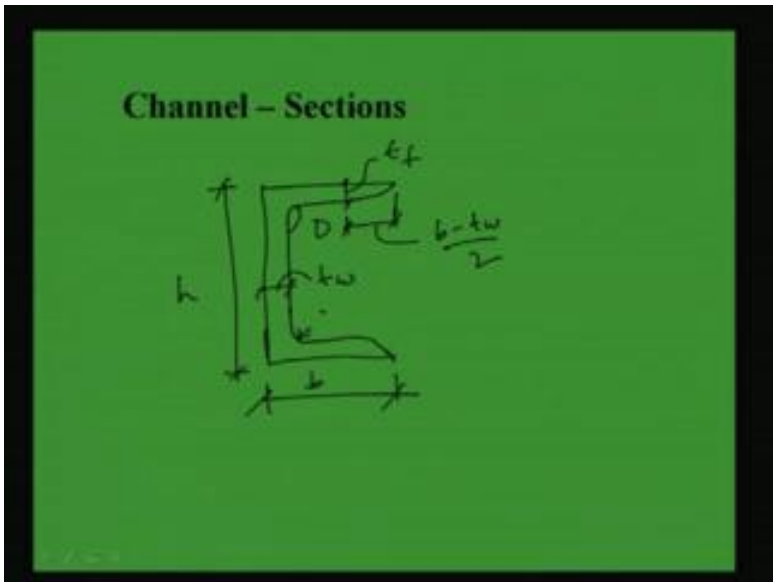

How does it look? For channel section it will be like this. So, in channel section also this is the depth of the channel which is written at h this is called the slope D, this is the thickness of the web tw this the tf thickness of the flange. And that will be at a distance of it will be measured at distance of b minus tw by 2 where b is the width of the flange and this is as usual r 1 and this is r 2. So, the name how it has been defined like different type of channel sections there.

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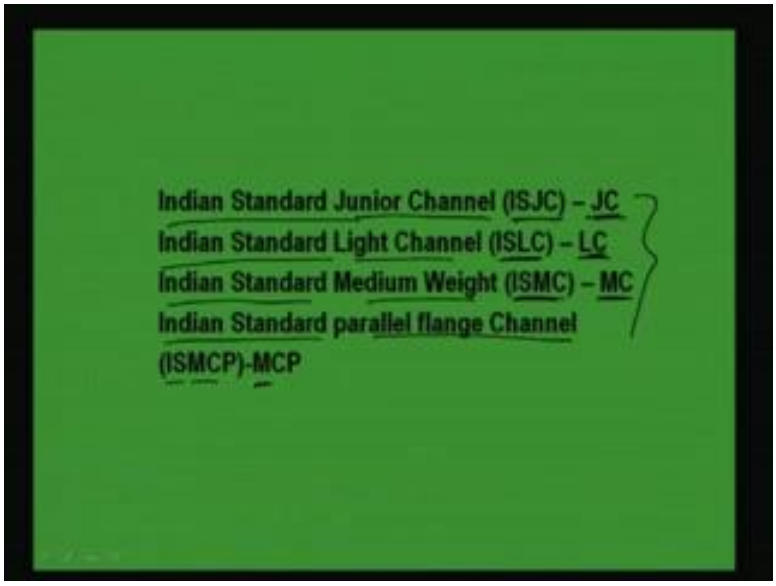

Indian Standard Junior Channel ISJC or JC, Indian Standard Light Channel ISLC light channel, Indian Standard Medium weight Channel ISMC medium weight, Indian Standard Parallel Flange Channel ISMCP or MCP like this it is also given. So, in this way for channel section also we can find out.

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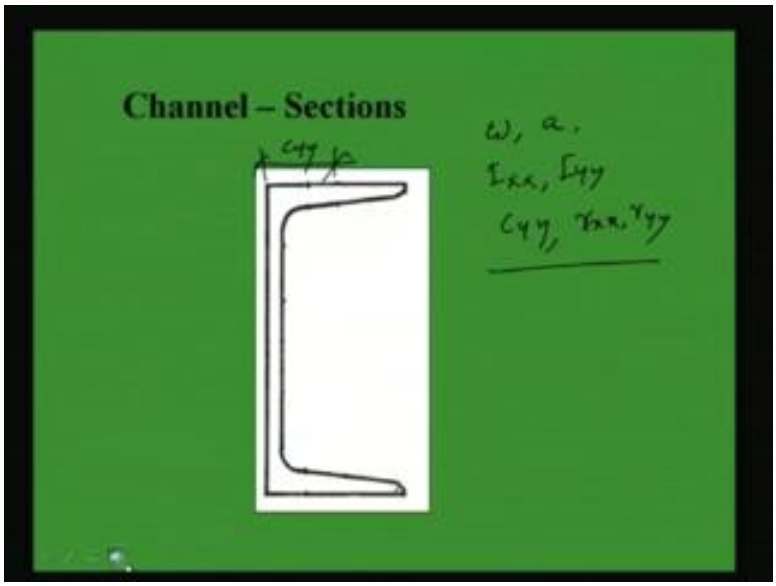

So, other things like Ixx Iyy Cyy. Cyy means the CG distance this is Cyy it is told. Cxx will be simply h by 2. So, that is not given Cyy then Rxx Ryy before that weight area and other standard details then the connection details everything has been given. So, I section channel section then we can see about the angle section.

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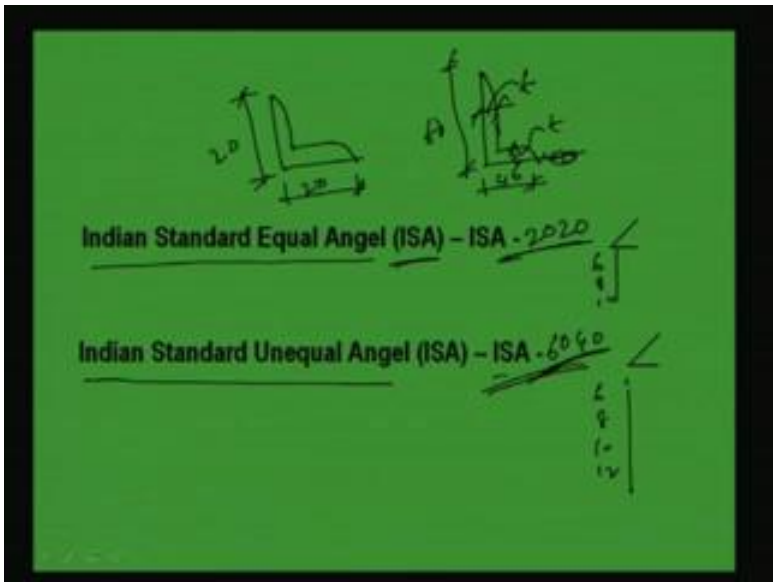

Angle section is denoted by Indian Standard Equal Angle ISA and in case of Indian Standard Unequal Angle also it is give ISA, but here say if let me draw first. Suppose, this is a channel of equal section sorry angle of equal section say this length is say suppose 20 mm. Then the name will be like this ISA 2020. And if it is unequal; that means, if it is like this say this, so like this then say this is 40 and this is say suppose 60. Then ISA 60 40 like this it is denoted again for ISA 2020 different type of thickness you will get thickness of channel means this thickness thickness of web, this is thickness. So, this also you will get different say you will ISA 2020 say 6 8 10 say 60 40. So, 6 8 10 12 like this you will get means with different thickness having same dimension in terms of its length you will get different type of channel sections and their properties. So, if we see the channel section. In fact, it looks like this.

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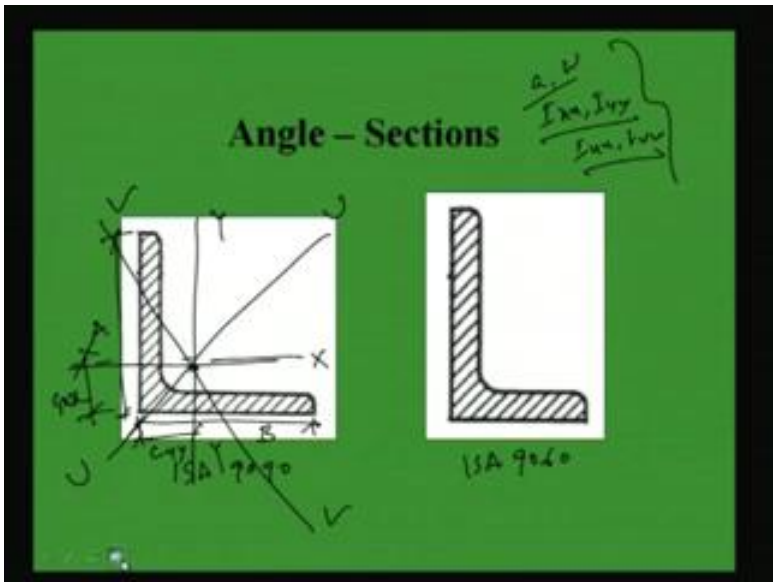

Say this can be denoted as ISA 90 90 equal and for unequal we can say ISA 90 say 60 something like this. And also you will see here properties will be little different, because the neutral axis will go through like this. So, this will be the CG. So, this distance is called Cyy not Cxx along yy direction this will be Cxx remember. This is x and this is y and this is this distance is called a and this distance is called b. And other means neutral axis will be means about major axis or about a minor axis, because this in this way also it can bend. So, this is uu and this is vv. So, here you will get Ixx Iyy not only this then Iuu Ivv. So, all the properties and then area width all these things you will get. So, all these required property can be found.

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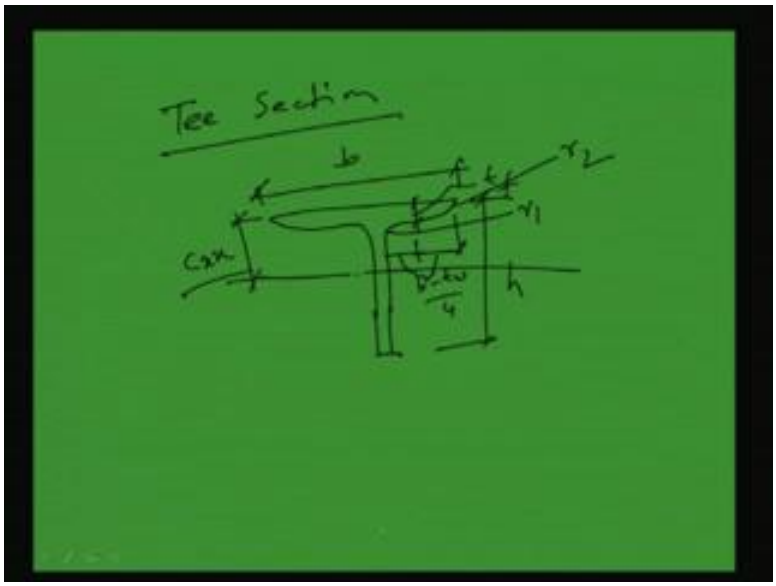

Another section we use is Tee section we do not have much time. So, I will not go into details just I will show the Tee section other sections I will not show. So, say suppose Tee section. So, in case of Tee section this is the b width and this is thickness of flange and this will be h depth of the section. And in this way we can find out and tf will be measured at distance of b minus tw by 4, this is also b minus tw 5 this is also tw 5 4. And this is called r 1 and this is called r 2 and if neutral axis is here then I can say this is as Cxx. So, these are the things in Tee section will be getting and the name we use to give as like this.

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Indian Standard Normal Tee Bars ISNT, Indian Standard Deep Tee Bars, Indian Standard Light Tee Bars, Indian Standard Medium Tee Bars MT ISMT, then Indian Standard Heavy Tee Bars ISHT. So, Heavy Tee Bar means HT medium Tee bar light Tee bar deep Tee bar normal Tee bars like this we use. Apart from this rolled section other type of rolled steel bar sections we will get.

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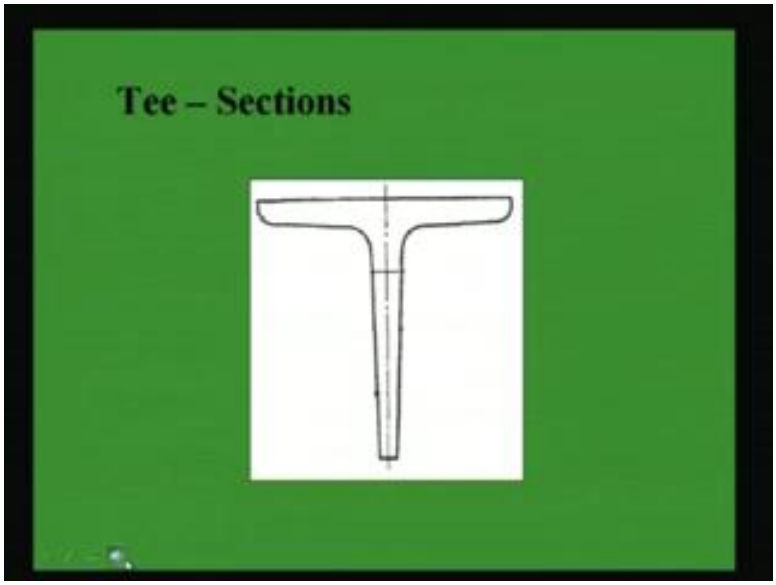

So, this is the Tee section.

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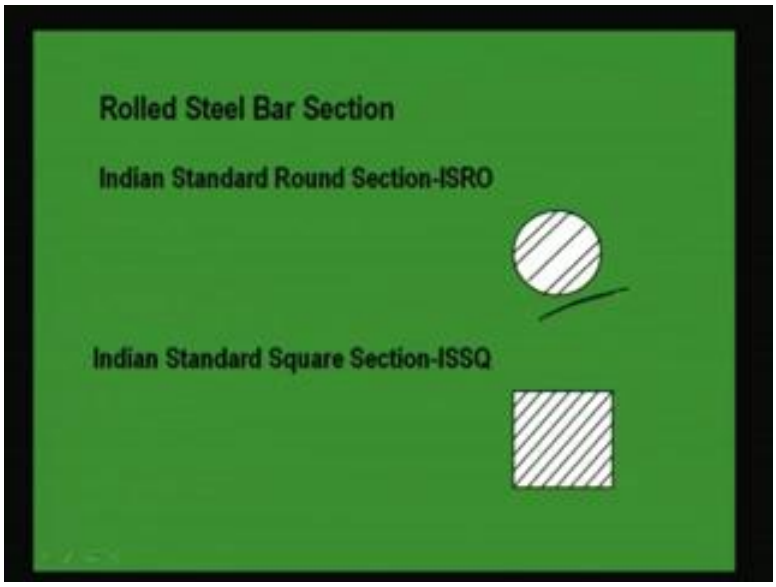

Indian Standard Round Section and Indian Standard Square Section.

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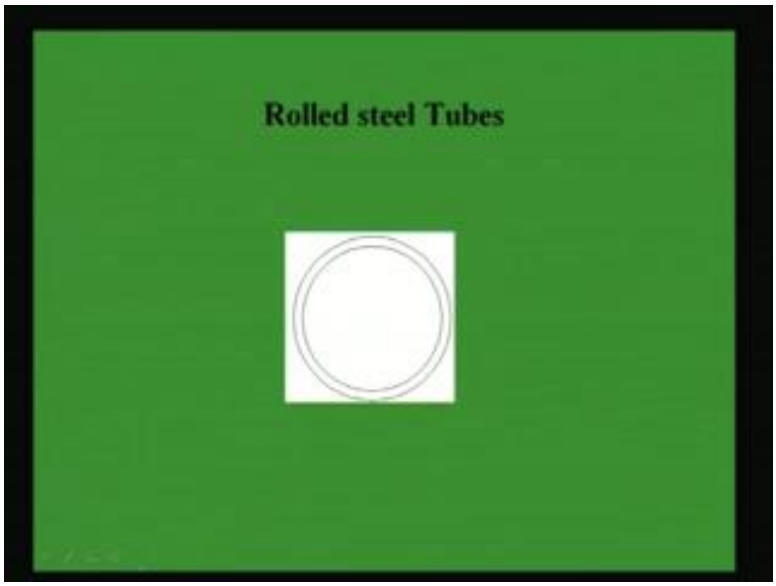

This is another rolled steel tubes.

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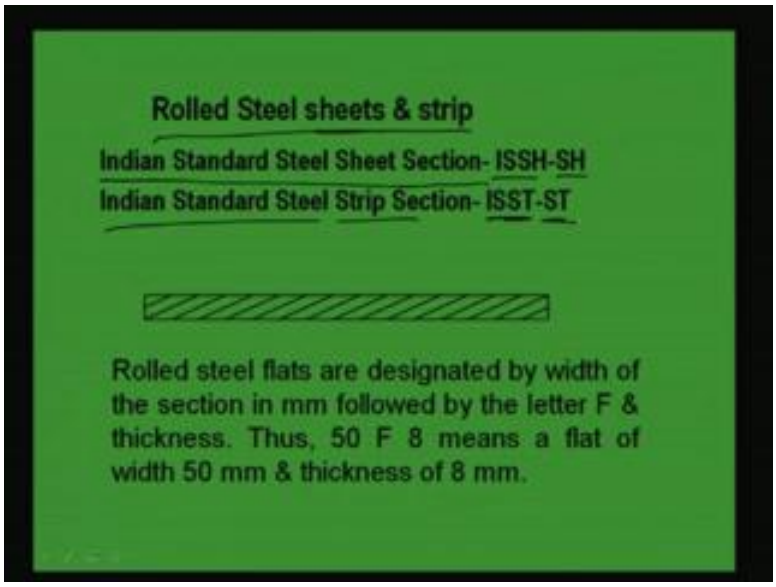

Now, other types of steel rolled steel sheets are that that we call Indian Standard Steel Sheet Section ISSH or SH another is Indian Standard Steel Strip Section ISHT or HT.

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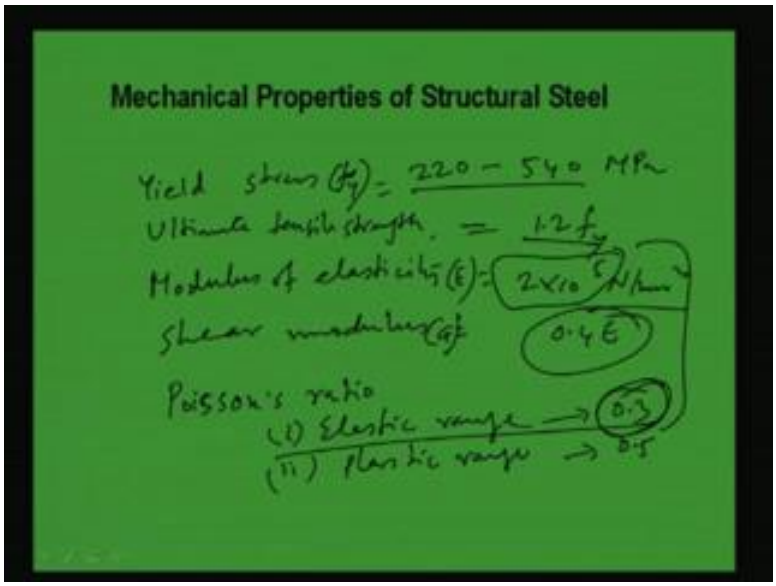

Now, some standard mechanical properties I will just right down here which is required like we generally use to say yield stress. Yield stress in case of steel varies from 222 – 540 ampere. So, depending on the type of steel this will vary. Then ultimate strength ultimate 10sile strength will become 1.2 into a fy. If fy is this yield stress fy is this yield stress. Then this will become ultimate 10sile strength will become 1.2 fy. Modulus of elasticity modulus of elasticity that will become 2 into 10 to the power 5 Newton per millimeter square that we will be generally considering. And shear modulus we will be using shear modulus which is called g that will be 0.4 into E.

E is the modulus of elasticity right and Poisson's ratio that also is required sometimes to calculate different values Poisson's ratio. For elastic range we will consider Poisson's ratio as 0.3 and for plastic range this is 0.5. Generally we use elastic range in case of steel design, so 0.3 we will use. So, this we have to remember 1 is Poisson's ratio 0.3 modulus of elasticity 2 into 10 to the 5 Newton per millimeter square. These 2 is very important and also shear modulus 0.4 into E. So, these are the mechanical properties we should know. Another thing is the stress strain curve for mild steel.

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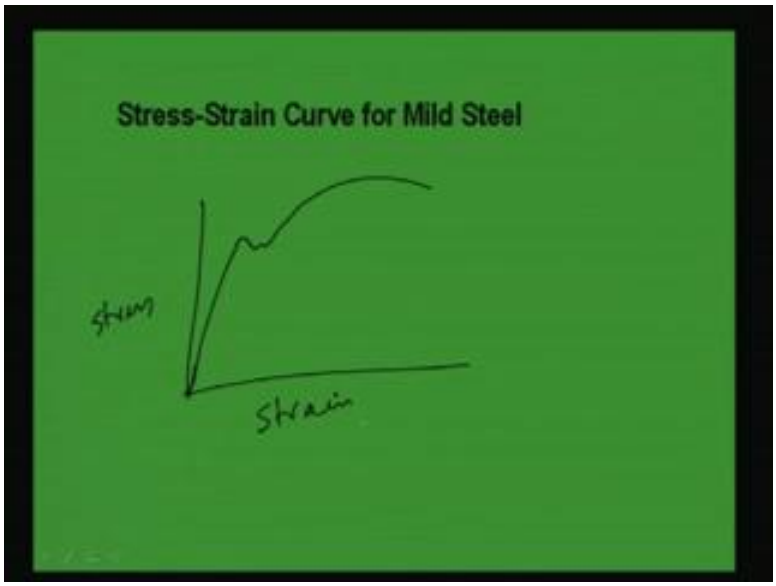

As we know the stress and curve will become just I am giving a small background, because you know we have started in strength of material. So, generally stress strain curve will become like this you know. So, here only thing I have to say is that. This is stress and this is strain only thing this is straight line only I have to tell that we will be going for design of steel structure by working stress method. Still now, in our country we are not following the ultimate load design method or limit state design method. So, for steel design we will be following working stress method; that means, we will following means the Hooke's law. That means, strain versus strain varies with stress varies with strain. Stress is proportional to strain or stress by strain is equal to constant that is E. E is equal to stress by strain. So, this condition we will be following. So, whatever design will be following that is working stress design method remember this is we will be going to follow working stress design method.

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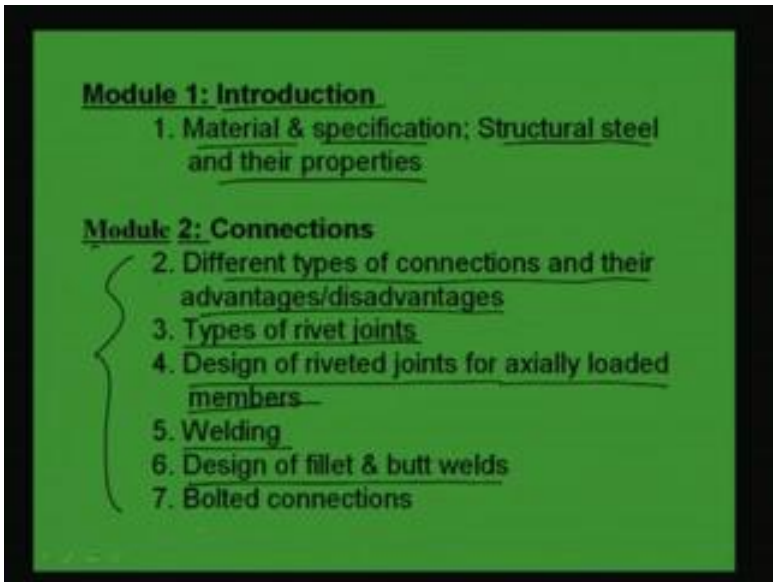

So, the mechanical properties now, we have seen we came to know that working stress design method will be using once again I am just giving an overview of lectures whatever I will be delivering. So, in module 1 which today I am I have discussed that is introduction where I have discussed about material and specification structural steel and their properties. Properties means that is mechanical properties and Hooke's law means elastic behavior only we will considering those things I have I have told here. And the specification how has been made in IS code those things I have discussed.

Now, from tomorrow onwards the lecture modules will be like this. In module 2 there will be 6 lecture. In lecture 2 it will be different types of connections and their advantages disadvantages. Different types of connection means say welded connection and bolted connection and riveted connections then in lecture 3 types of rivets joints. Lecture 4 design of riveted joints for axially loaded members, Lecture 5 welding, Lecture 6 design of fillet and butt weld, Lecture 7 bolted connections. So, these are the name of the lectures which I will be going to discuss. In next module; that means, in module 3.

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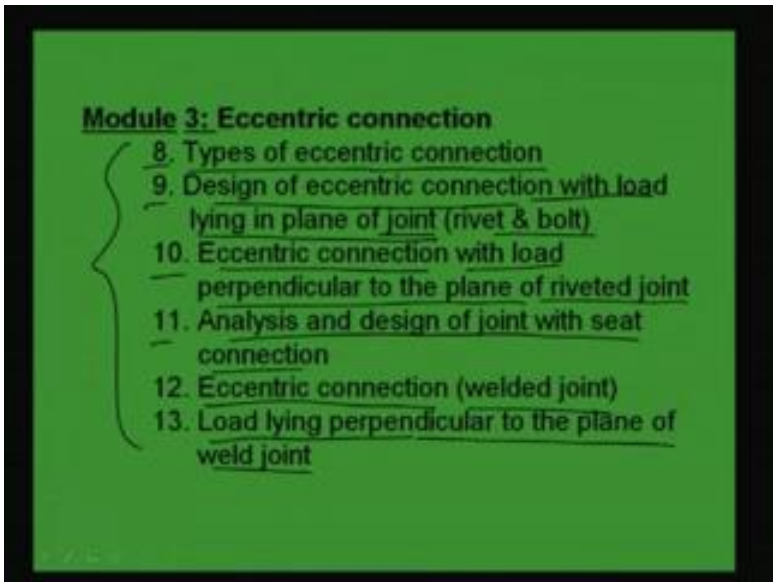

We will be discussing again 6 lecture, we will be spending for module 3 right in eccentric connections. In lecture 8 it will be types of eccentric connection and in lecture 9 design of eccentric connections with load lying in plane of joint for rivet and bolt. And in lecture 10 eccentric connection with load perpendicular to the plane of riveted joint. Lecture 11; analysis and design of joint with sheet connection. Lecture 12 will be eccentric connection with welded joint and lecture 13 will consist load lying perpendicular to the plane of weld joint. So, these are the lecture I will develop these are the title of the lecture. In module 4 there will be 4 lectures.

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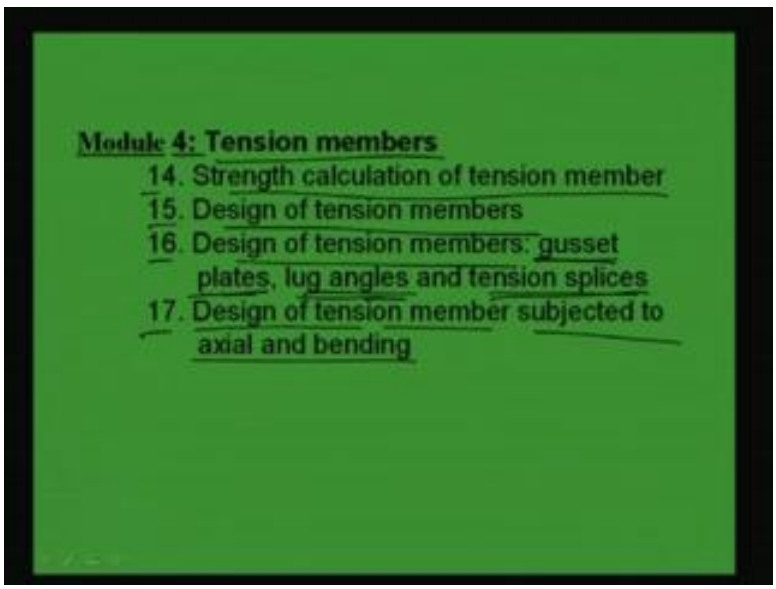

Module 4 will be focused on tension members. In tension member what are the things we will discuss that in lecture 14 we will discuss strength calculation of tension members. Strength calculation of tension members; that means, the net effective area gross area of the tension member and the net area of the tension member deduction of area due to hole. All these things efficiency all these things we will discuss. In lecture 15, we will discuss design of tension member what are the steps and how we will design? Then lecture 16 design of tension members. Gusset plates lug angles and tension pressures means all these things we will discuss. Gusset plate design lug angles design and tension pressure design. And in lecture 17 we will design of tension member subjected to axial and bending. Design of tension member subjected to axial and bending.

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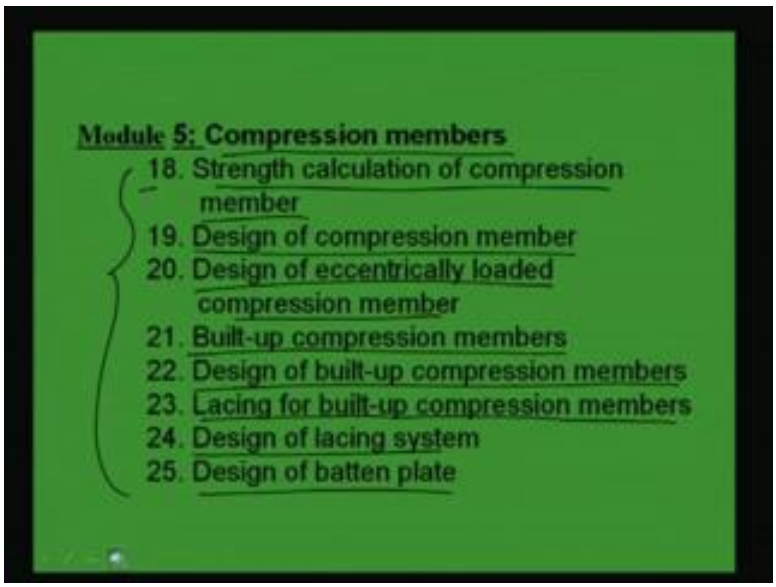

In module 5, we will discuss about compression member which is consisting of 8 lectures. In 18, will discuss strength calculation of compression member, then 19 designs of compression member, 20; design of eccentrically loaded compression member, 21; built-up compression member, 22; design of built-up compression member, 23; lacing for built-up compression members, design of lacing systems and 25 design of batten plates. So, all these things we will be covering in module 5.

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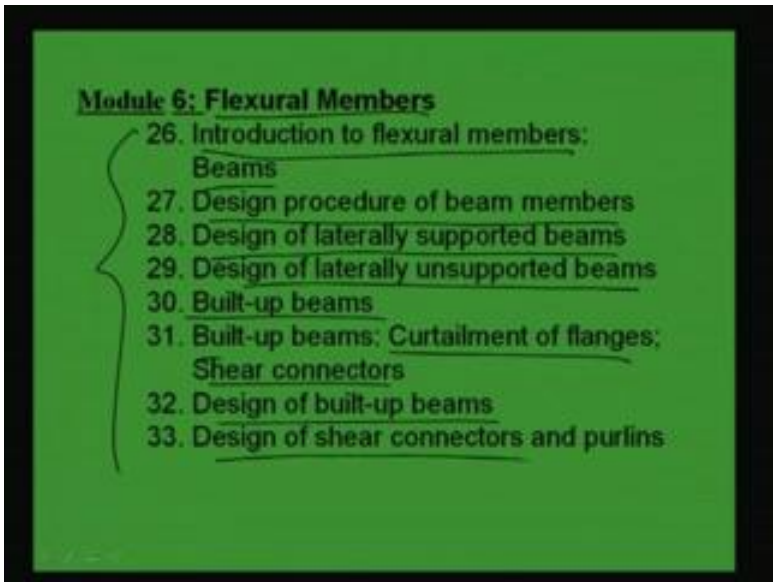

In module 6, we will be discussing about flexural members where again 8 lectures will be providing. One is introduction to the flexural members beam then design procedure of beam members, Design of laterally supported beams, Design of laterally unsupported beams. Then we will go to built-up members along with curtailment shear connectors then design of built-up beams and then design of shears connectors and purlins. All these topics we will be discussed here.

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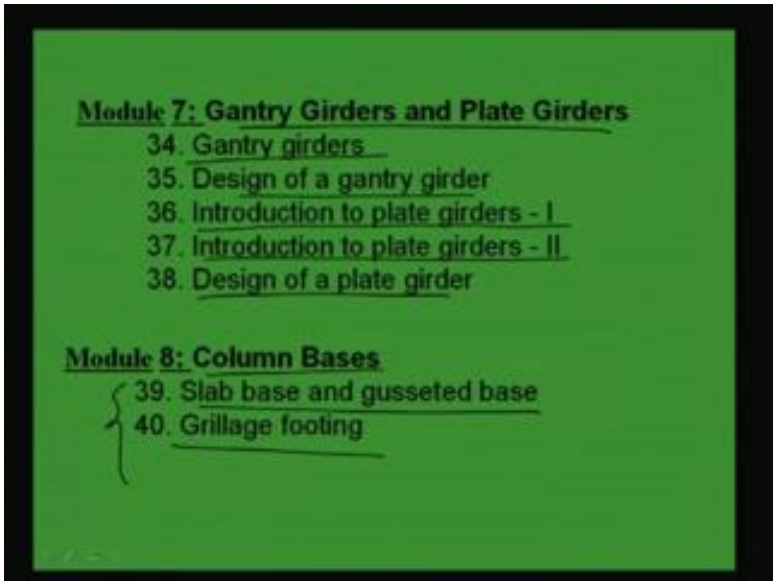

And in module 7 we will discuss about gantry girder and plate girder. First we will go to introduction of gantry girder then design of a gantry girder. Similarly, in case of plate girder introduction to plate girder 1, introduction to plate girder 2 then design of a plate girder. And in module 8; we will discuss about column basis which will be consisting 2 lectures 1 is on slab base and gusseted base and another is on grillage footing. So, with these 40 lectures we will conclude. I hope you will purchase the code first then you will listen to my second lecture. Because unless we have the, we will not be able to follow the design classes. With this I like to conclude today.

Thank you very much for your patience for listening my lecture.