Financial Management for Managers
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Lecture 15
Time Value of Money Part 6

Welcome all. So, we discussed the concept of the present value of annuity in the previous class. And now, we will learn about 2, 3 or 4 important applications of the present value of annuity. And the first application given here is that for example, somebody want to buy a car. So, everybody has a budget, the different cars, cars for the different prices are available in the market and everybody has his own budget because everybody cannot buy the car of any budget or any price in the market that is all related to the income of the person, the rate of savings of the person, number of years he can earn and he can save.

So, he has to find out or somebody has to find out that if he has the certain given amount of the income and out of that income, he can save a certain sum of the money for a given period of years or number of years or months, then, means, what will be the present value of that total amount.

So, that he can come to know that equivalent to that present value of that savings for the next number of years, 3 years, 5 years, he can buy the car, so that he is comfortable in returning that money back to the finance company and means his all overall budget is also not disturbed. So, in this case, for example, we are say a say, trying to find out the answer to this question.

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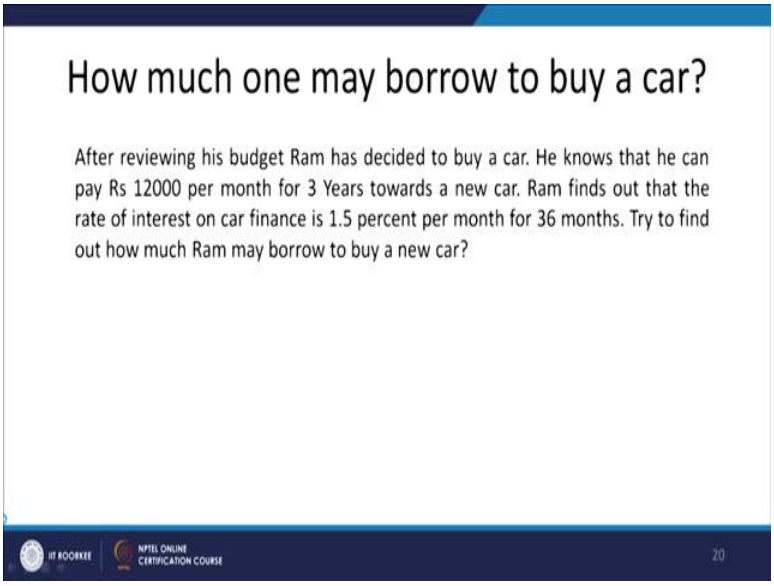

And here, the question is if, for example, that after reviewing his budget Ram has decided to buy a car. He knows that he can pay rupees 12000 per month for 3 years towards a new car. His surplus of 12000 will be available with him for a period of next 3 years for 36 months to buy a new car.

Ram finds out that rate of interest on the car finances, 1.5 percent per month for 36 months for the next 36 months or 3 years, the rate of interest we charge by the car finance companies will be 1.5 percent. So, try to find out how much Ram may borrow to buy a new car. So, you have to simply, what you have to do is it is a very simple question, you have to find out the present value of a certain sum which is 12000 rupees is going to come back to Ram over a period of next 36 months rupees. So, the total amount if you multiply 36 into 12.

So you can find out that this amount is going to be certain sum; 12,000 into 36. That sum easily can be calculated. But that amount which is going to come back, is going to come back over the next 36 months.

So the value of that is not going, going equal to the say 12,000 into 36 months it is going to be something less than that, because it has to be discounted against a discount factor and the discount factor here is the interest rate and that discount factor is that 1.5 percent per month or you can call it as 18 percent per year. So, we have to find out the say present value of this

annuity, which is 12,000 rupees going to be saved for the period of next 36 months. So, what is going to be the say discounted value of this annuity.

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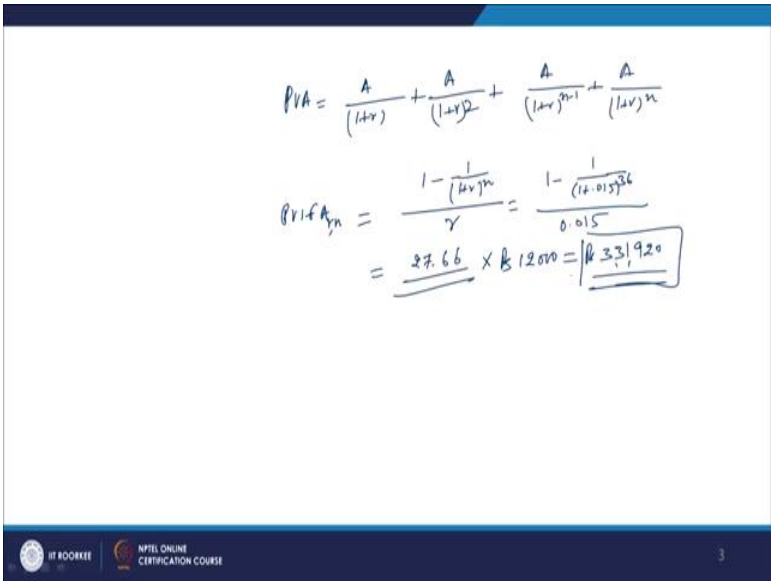

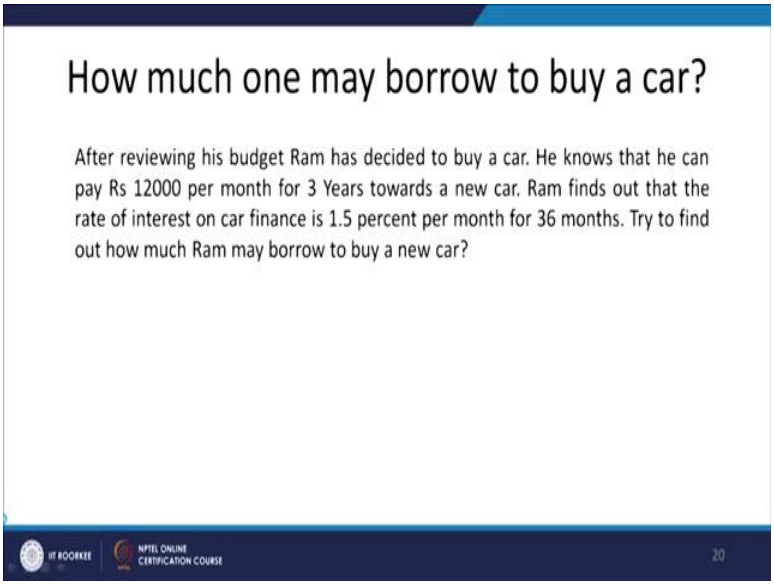

So, here in this case, what you have to find it out you have to find out the PVIFA present value interest factor for the annuity you have to find out, simply have to find out. Generally as I told it is given in the tables you can make use of the tables in any examination you are allowed to make use of the tables.

So, it is given there, but I want to explain to you that in the tables also how it is calculated. So, it is calculated with the help of the model and for calculating here in this PVIFA for a given

number of rate of interest and number of years r and n here we have to find out if you try to find out if you means the expand this the model becomes something like this 1 minus 1 by 1 plus r this is 1 plus r power n, and 1 minus 1 divided by 1 plus r power n and whole divided by r, whole divided by r.

So, in this case, you have to place the values. So, the values are 1 minus 1 divided by 1 plus R is how much in this case? 1.5 percent per month. So, this becomes in the percentage terms point this in the percentage terms becomes we have to convert that into the say percentage terms and this becomes 0.15. Because it is 1.5 percent, so this becomes 1.015 and how it is our power, because it is a monthly the interest rate is given to us is monthly.

So, you have to take the power also in the months, that is 36 months you cannot make the power 3 say 3 years because interest rate is given to us in months is not in the years and so, this becomes 1 minus 1 by 1 plus 0.015 power 36 months and whole is the rate of interest is 0.015. So, you can calculate if you solve this you will get the present value interest factor for annuity this factor will come up as 27.66 this is a factor.

Now, this factor will be equally available in the table also you can easily find out from the table that for a certain sum of money, if you want to find out the present value of that annuity, you go to the present value interest factor for annuity there the table is given on the vertical axis number of years and on the say this horizontal axis you are given the rate of interest. So, you can find out against 36 if you want to calculate the 36 months.

So, it means 3 years will be given to you, but since it is in the month, so, you can convert yourself there it is given the years, but with the help of this model we can convert it into months. So, you can easily find out that if you want to find out for 36 months, it comes up as 27.66 say, not percent, but this is a value is called as absolute value 27.66 is the present value interest factor for the annuity and with this what you have to do is you have to multiply your sum that the amount which is available with the person who want to buy the car multiply by this and if you multiply this, this some becomes how much rupees 331920 rupees, 331920 rupees.

So, it means, in this case, this sum is going to be available with the person, this person Ram who want to buy a car. He can buy a car he can borrow the money from the finance company

depending upon, upon his income and his savings rates, the amount which is going to be available with him is 331920 rupees.

For this sum of money for 331920 rupees, Ram can think of buying a car if he buys a car for this much amount around 330,000 rupees or maximum he can go up to 335 or 40,000 rupees, then he will be comfortable in returning the money back to the finance companies because his rate of saving is 12,000 rupees per month and since the rate of interest is 1.5 percent per month or 18 percent per year to be charged by finance company. So, his budget allows him to buy a car worth rupees around 330000 rupees, 330000 rupees car he can buy from the market.

So, with the help of the present value of annuity, you can answer this question; easily you can answer this question, it is a very important application which is very, very helpful for taking a very important decision which affects the individual's life.

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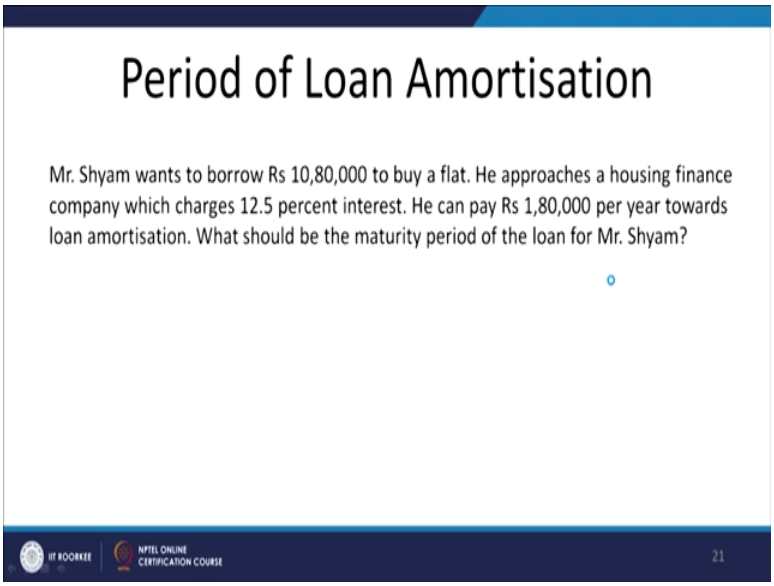

Then the, another important application is period of the loan amortization, period of the loan amortization. Now, what is the period of loan amortization? First I would like to explain it to you. Loan amortization means when any loan is taken by any person, maybe housing loan, a car loan or any loan, when it is taken, it has to be returned back to the to the source from where it has been taken the finance company or any bank or any source where it has been taken from it has to be returned back and when it has to be returned back it has to be returned with the interest.

So, amortizes means any amount of the loan taken by any person and to be returned back any amount which is taken and that has to be returned back. So, returning back of any loan, along with the principal and interest is called as the process of amortization. Along with the principal and the interest that process returning of any loan taken by any person or any organization along principal means the both including both, including both principal and interest is known as the process of amortization.

So, amortization of a loan here, we may be given a certain sum of information, that for example, we want to borrow a certain sum of money and the rate of interest will be charged by the source from where the funds will be borrowed is this much and every year, the person can, can pay a certain sum of money back in the form of annuity to the source. So, in how many years that loan will be fully paid back to the source. So, that is known as the period of amortization, we can find out the period of amortization.

So here for example, the application given is Mr. Shyam wants to borrow rupees 1080000 rupees, 1080000 rupees he want to borrow to buy a flat he wants to buy a house, the price of that houses 1080000 rupees, 1080000 rupees. He approaches a housing finance company, which charges 12 percent interest, he approaches a housing finance company which charges 12.5 percent interest and he can pay 180000 rupees per year towards the loan amortization, he can pay rupees, 1080000 rupees per year towards the loan amortization, what should be the maturity period of the loan of Mr. Shyam?

What should be the maturity period of the loan of Mr. Shyam. Maturity period means that period of amortization and that amortization is means in say, sum total of the principal plus interest on that in how many years he can return the load back. Because, everybody has a plan that I am going to have a certain sum of money available for say 180,000 rupees per year for the next 10 years.

But, after that my children will grow and I need the funds for their education. So, this amount will be used for that purpose, and this will not remain as a free amount. So, it means people have their own plans own budgets and their own time periods. So, the time of the amortization of 1 particular liability has to be known in advance.

And if that period for that period, if the that period is permissible to the person, he can take that desired sum of money, otherwise, he has to redo the whole thing, he has either to reduce the say the total sum of the money he wants to borrow or he has to look for the alternative, where the rate of interest is comparatively lesser.

So, he has to take all the decisions. So, here the information given to us is there borrowing amount is 1080,000 rupees, interest will be charged by the company will be that is 12.5 percent per annum, and the amount which he can pay in the form of the annuity to the company is that is 1080,000 rupees. So, it means, he, in this case he has he want to find out the period. In the previous case what he wanted to find out was how much the total amount, that he wanted to find out the total amount.

Here the other information which was given was the time period was given the rate of interest was given and the say the amount the annuity amount, which he can return back or make use of returning back the loan was given to us, but only thing missing was the sum he can borrow with this given information, but in this case, he is given all other information, but the period is missing that in how many years, he can return the loan back. So, that period is missing here.

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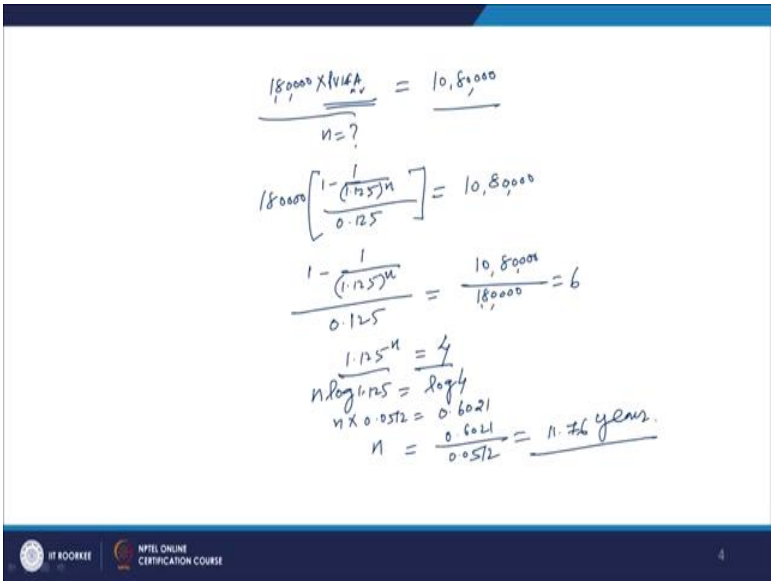

So, for calculating that means, that period of the amortization, we can means understand it in detail, how to find the period of her motivation and for this what is the total sum of the money he want to borrow 1080000 rupees. So, he is going to borrow this much of the amount 1080000

rupees and now it has to be made equal to something like this left hand side how much he can pay annually.

That is 1080,000 rupees and multiplied by the present value interest factor for annuity and in this case, we are known as r plus n or n plus r. This information we have to put here this is an n and r is given to us. Let me write it more clearly, that is n and r we have to put here. So, if you take this amount here is that is the number of years and combine it is we have to it is very small.

So, means, sometime it is connecting with each other. So, we are talking about n and it is r. Number of years, present value interest factor for annuity for the given number of years and at the given rate of interest. So, means both the sides are going to be equal if you say this, this is equal to this and this is equal to this. Now, in this case, there is something which is missing. In this case the missing part is R is given to us that is 12.5 percent but the n is missing here n is not given to us which is missing here.

So, you are given here 180, he can pay it is given and for calculating the present value of this annuity for a period of a certain number of years, which is not known to us at the rate of interest of 12.5 percent. So, we want to find out that period and that means, sum he wants to borrow his 1080000 rupees. So, in this case what the missing is the value of n is missing we want to find out the value of the n which is missing here.

So, for calculating the value of the n you can make use of this entire process this model evaluation model and in this case, what you have to do is you have to expand now this model here. So, it will become something like this 180000 and multiplied by this model here and this is multiplied by something. So, what is this we have already written that model, 1 minus 1 divided by something and this something is becoming how much 1.125 because the rate of interest is 12.5 percent and what is this n it is missing we do not know this n and finally, you have to divide it by again 0.125 this is 12.5 percent .

So, this model becomes this, this equation becomes this if you put the values in this, this becomes 1 minus 1 divided by 1.125 power n and divided by 0.125 and the bracket is closed and finally, this sum has to become the equal to 1080000 rupees. This sum has been to become equal to the 1080000 rupees. So, here for going for this further calculation and for the further solution.

So, if you want to find out the n here, you have to now do this that it will be something like this 1 minus 1 divided by 1.125 power means n which is not known to us and divided by 0.125 is going to be how much this is going to be, how much, is going to be 1080,000 and divided by something this something is going to be how much 180,000 rupees. So, this value will come up as 6 this values will come up at 6 and if you solve this entire thing.

So, it will become something like this 1.125 then this will become if you solve this I am taking the shortcut, omitting 1 step. So, this value becomes finally 1.125 power n is equal to 4. If you solve this, this value will become 1.125 power n is equal to 4 and now from this onwards you can take the help of the log. If you take the help of the logs it will become something like this n log, what is this value? 1.125.

Log 1.125 is equal to log 4 with the help of log you can easily find the solution to this. So, this will become n into log values of this particular thing is, the log value is going to be 0.0512. And this is going to be finally, if you solve this the log value for the 4 is going to be how much that is 0.6021. This value is going to be 0.6021. So, finally, if you want to kind, find the value of n and will become 0.6021 divided by 0.0512 and this amount if you try to find out comes up as 11.76 this value if you want to find out and this is called as years 11.76 years.

If you want to find out easily you can find out with the help of this, that is the 11.76 years is going to be the your say period, the value of the n that if you want to borrow this certain sum of money, money that is that 1080,000 rupees and the rate of interest will be charged by the housing finance companies 12.5 percent and annually the person can pay 180,000 rupees for a certain number of years.

So, he wants to find out that how many years would it take to amortize the total loan of the 180,000 rupees, which will earn which will fetch an interest rate of for which will cause an interest rate of 12.5 percent . So, in this whole calculation, we have been able to find out with the process of calculating the present value interest factor for annuity, we have been able to find out here that if you say make use of this present value and trust factor for annuity model, then you can easily find out the answer to this question that in how many years the loan can be returned back or how many years a time would it require to return the loan of 1080,000 rupees 1080000 rupees say given the number of other particulars.

So, very important and very interesting question it is and we can easily answer with the help of this process you can answer this question. So, because here you can find out that every time every question is not to be answered with the help of the table as the value is given in the table, many times you have to means do the manual calculations also and in this process, sometimes when the calculation becomes tedious, we make the use of the log and we use the logarithm and by making the log values or by making use of the log values, you can easily find out the desired results.

So, we have found out that desired, desired results here is that the period is 12 years that is 11.76 years or roughly you can call it as that to return this amount with interest rate of 12.5 percent you need roughly a period of 12 years. So, if you have 1080000 rupees available for the next 12 years surplus amount every year, you can spare this amount for the next year, 12 years borrow this amount. Otherwise, look for the alternative. So, very important means application of the present value of annuity and we could answer a very interesting question.

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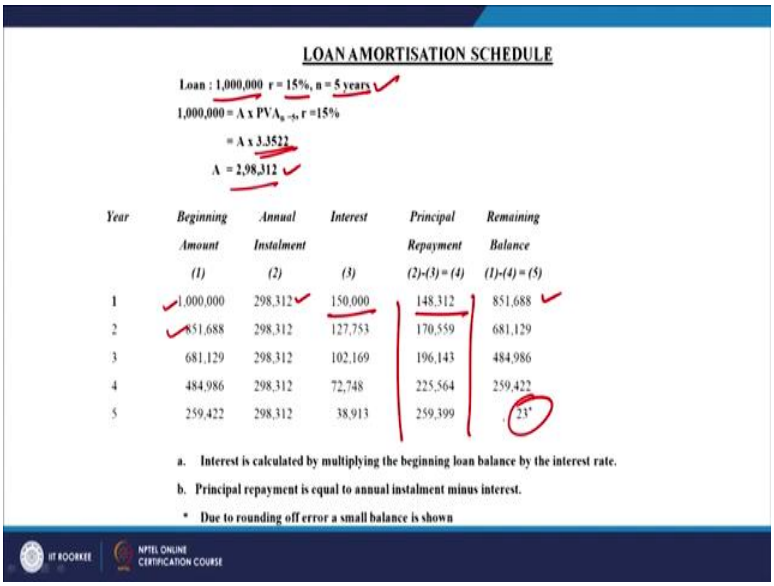

So, in this case, the loan amortization schedule if you look at you can easily be able to understand that how, means, useful this table is, which is given in the book and in the book of the financial management by Prasanna Chandra, this table I have taken from the book and if you look at this entire this calculation, which is nicely done beautifully done and first is given to you

there for example, again and other information is given to us that somebody want to borrow a loan of 1 million rupees.

Which is given to us here and the rate of interest to be charged by the say the company or the source from where the loan has to be taken is 15 percent and the number of years is 5 years, then say, in this case, say how much is going to be the say in this if you want to find out the loan amortization schedule, then annual installment is going to be how much you can easily find out the end installment also 10 lakh rupees, 1 million rupees somebody want to borrow rate of interest to be charged by the finance company 15 percent, number of years is known to us that is 5 years.

So, what is going to be EMI that is that you equated monthly installment is going to be how much? So, far this calculating this total amount of the equated say installment the value of the A the value of that annuity, which is because now in this case what is missing and what is missing annuity is missing. So, it means anything if the other things are given to us and any 1 thing is missing, we can easily find out. So, in this case that annuity value that installment which we want to pay, annual installment not monthly installment the annual installment which somebody want to pay is or somebody can pay is on this borrowing 1 million rupees at the rate of 15 percent for a period of 5 years.

So, annually he ends up paying this much of the installment. So this has been worked out with the help of the same model and the factor which is calculated here is that is 3.3522. So, that A if it is multiplied by this factor. So, it means we have already got about 1 million rupees and this side is A into multiplied by this factor. So, finally, the value of the A comes up as298312. So, now the all the calculations are shown here very clearly if you look at this, you are given the number of years 5.

Which is given to us the period is 5 years and the beginning amount is also given to us how much is loan in the beginning 1 million rupees and the first installment at the end of the 1 year which we are paying is 298312 rupees which has been worked out here. So, this installment is going, so and. Then the balance is remaining with us is this minus, this is now the this amount 851688 rupees.

Now the very interesting part here is you can find out here is which we want to remain which always remain curious to know that out of this 298312 rupees, how much is the interest we are paying against this loan of the 1 million rupees and how much is a principal payment has been made and very interesting fact has emerged here that out of this total payment of 298312 the total payment which you are making, you are paying principal as lesser amount as compared to the interest we are paying.

So, interest payments are more than the principal payments. So, interest is 150000 rupees and the principal going down is by 48, 148312 rupees. So, this way now, the closing balance which is diminished balance reduced balances 851688 rupees is left here, which becomes the opening balance for the beginning of the second year again we pay this amount again the balance comes down to this and out of this amount when we are paying.

Now what is happening it has become reverse; that interest component has come down and the principle of common component has gone up and for the other years if you talk about again it keeps on changing. So, means you go to the third year in the third year also we are paying this much amount. So, interest component is this much and this is a principle and now this is a closing balance.

And when you are talking about this part here now, the closing balances this much and this part is the installment we are paying. So, finally, the this is the amount of the interest we are paying here and then the balance principle amount of this amount we are paying here. So, now, the closing balance we are left the us is 259422 rupees and finally, we are means reaching up to the final year this is a closing balance, this closing balances coming up here and see again we are paying the installment, this is bifurcated into the principal and interest and finally, this amount of 23 is left.

So, this amount is just you can call it as because of the say approximations. So, finally this figure should be 0 should not be 23000 or any amount, this should be 0 but just because the approximations 23 is the end amount is left with us. Now, here important question is how we calculate the principal and interest how we bifurcate the principal and interest we are able to find out the value of an annuity that is an installment annual installment with the help of this present value interest factor for annuity model, but for bifurcation of the interest in principle, how does it happen or how does it take place?

You have to find it out with the help of this that interest is calculated by multiplying the beginning loan balance by the interest rate. So, it means is how you found it out. The rate of interest is 15 percent beginning loan amount was 1 million multiplied by the 15 percent means 1 million into 0.15. So, that becomes 150000 rupees in this case also this is 851688 rupees multiplied by 15 percent. So, this is interesting amount.

Similarly, now, this is the amount here is 484986 rupees multiplied by rate of interest. So, this is amount, so it means with the same beginning amount, what is principal amount in the beginning of the year leftover as a reduced balance or the beginning balance multiplying that balanced by the rate of interest, you can find out the interest component and principal repayment is equal to the annual installment minus interest.

So, annual installment is 298312 rupees. So, interest we have subtracted from this value. So, finally, you are left with this part which is called as the principal repayment. So, very easily you can bifurcate and you come to know that I say how the say the total installment can be worked out and the total amortization schedule can be prepared and how the total this installment can be worked out and in that installment, what is the proportion of the interest, what is the a proportion of the principal and in how many years or in 5 years or in this any number of years how that loan amount is going to become 0 or fully amortized or fully paid.

So, in this entire calculation, one important thing which is for practical use for all of us is that you see when you take any loan, especially the housing loan or any loan, when you take then in the initial number of years, in the initial number of years, the interest component in the EMI, EMI is higher than the principal component. So, it is always advisable that if we want to return the money, we should pay the higher amount of installments in the beginning. So, that the principal amount comes down seriously quickly.

So, that at the later stage, the whatever that know the balance left with us is there the paid more as the principal and less as the interest. So ultimate any investment decision and repaying of that borrowing, we have to means be careful that interest component which remains very high in the initial installments, we should try to bring it down as early as possible and that can be done by paying the larger amount of the say sum in the beginning, if for example the EMI annual installment works out here is as 298312 rupees. But if somebody has got surplus funds more than this, then it should be deposited in the loan account.

So that this loan account balance goes down very effectively, very seriously very quickly and at the later stage, you end up paying more as a principal component less for the interest part and with by paying the minimum amount of the interest on any borrowing the loan can be amortized, or that total say the borrowing can be amortized and the person can become free of any kind of the borrowings.

So, it is a very, very interesting application of your present value of annuity, that if we want to borrow anything, then in how many years we can pay, if this question is we want to answer you can find out the number of years if you want to find out the even interest rate you can find out, if when you when you find out the installment annual installment you can find out. So all these applications are very useful for our day to day life also for the corporates life also and we will be making use of these applications over a period of time.

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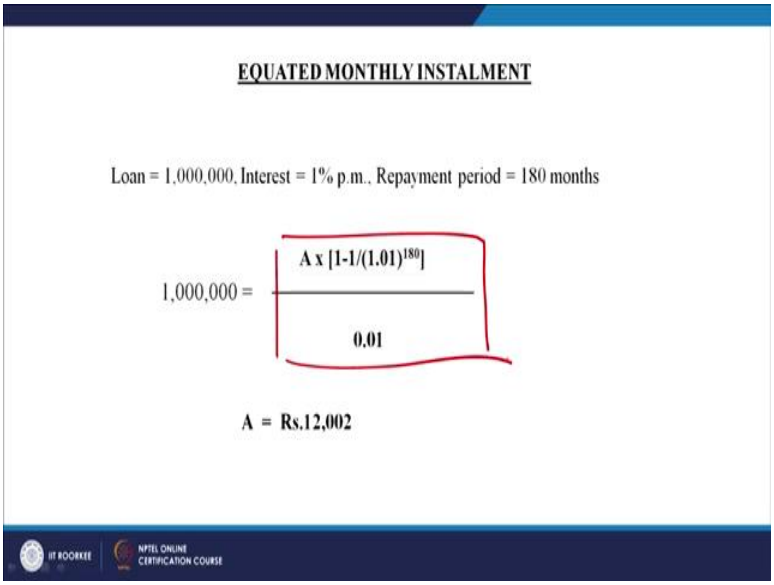

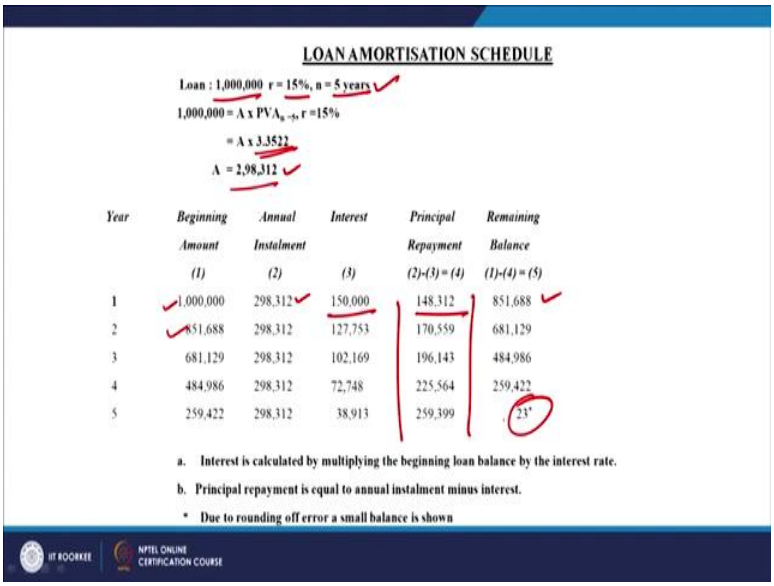

So, this is a process how you can calculate one more application here is how you can calculate the EMI equator monthly installment. Earlier this installment which we worked out was annual installment it is very simple to calculate, but for calculating the equator monthly installment the process is a little different here. So, the model is given you have to look at, at this model, which is very, very important model always be careful about this model, .

So, for example, again we are given here is as the loan amount is 1 million interest is 1 percent per month, 12 percent per year means and repayment period is 118 months, because normally the repayment period, for example if it is given a months interest also we have to convert it to 2

months if it is given in years the interest also we have to convert it into years. So, in a repayment period is period is given in the month.

So, we are converting the interest also we are considering interests also in the month. So in this case, EMI equator monthly installment can be worked with the help of this model, and in this case, for example, the total amount was 180 months and this information is given to us. So, you can calculate EMI for this borrowing at this rate of interest for this much period of time will be rupees 12002, rupees 12002.

So, these all are the applications of the present value of the money, present, value of the annuity not means any amount and even sum, uneven we have discussed earlier also. But in case of the annuity this is the way how we can calculate the present value of an annuity and if we know that we are going to acquire something on the borrowing basis and we are going to pay it over a number of years, then this much of the amount I can or anybody can pay annually for acquiring that particular asset.

Then easily with the help of these applications of the present value of annuity. The answer to all the questions or concerns or related questions can be found out. So, means with regard to this present value of annuity and the say this particular concept of say time value of money, I will stop here and some other related aspects some other important concepts of the time value of money, I will discuss in that next class, I would prefer to finish the discussion on the time value of money in the next class.

So, that after that we can move to the next part of discussion. So, for this class and the time value of money, I will stop here and remain in discussion we will have in the next class. Thank you very much!