Financial Mathematics
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Lecture-10
Problem Solving on Interest and Bank Discount

Welcome to the lecture on problem solving on interest and bank discount. So in this lecture whatever we have studied during the week 2 in the last few lectures will discuss few problems based on those contents and they are basically involving the interest problems and also the bank discount problems. So coming to the problem will be writing the problems and we solving them one by one.

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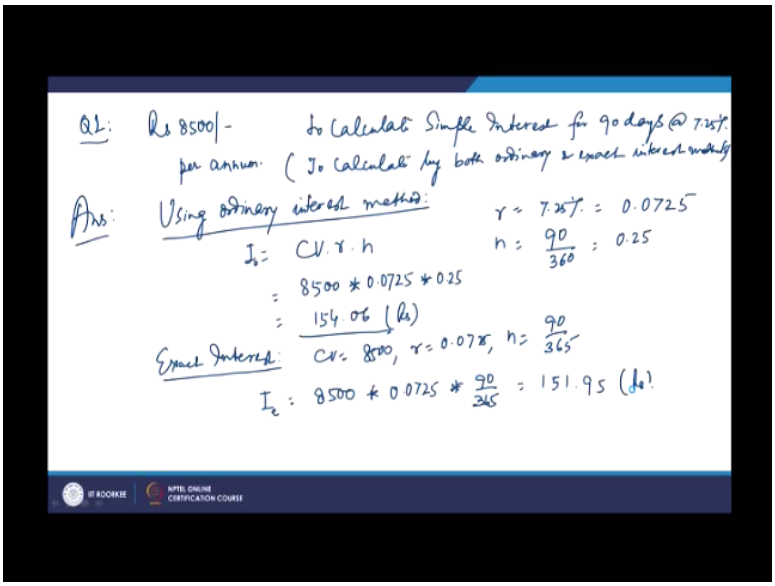

So suppose question 1 is about the finding the interest and suppose you have Rs. 8500 and on that you have to to calculate simple interest or you know for 90 days and the rate of interest is 7.25% per annum. So you have to find the interest and the interest should be found you know by the ordinary as well as the exact interest you know amount. So to calculate by both ordinary and exact interest methods.

So as we have discussed that when you are calculating the interest so if the dates are given you will find the number of days for which the interest is to be calculated and then since the interest rate is expressed for the year or you know on annual basis. So you have to divide it by the number of days in the year and number of days in the year you know we know that it is 365 in normal cases and 366 in the case of leap years.

So that 366 you would not consider unless otherwise specified that year to be divisible by 4 so that its leap year, but otherwise in the exact case we take the number of days has 365, in ordinary methods we assume that the year is composed of 12 months and every month is of 30 days. So that is what the extra proximate the number of days will be 30*12 360. So if you calculate so you know once you calculate the answer so using ordinary method, ordinary interest method.

So interest will be we know that it is the current value*rate of interest* and so i will be current value*rate of interest*n, now here rate of interest is 7.25% per annum. So it will be 0.0725 and n will be this 90 days so for ordinary it will be 90/360, so it will be 0.25. So now we will do that is CV is given as you know 8500, so it will be 8500*r that is 0.0725 and that multiplied by n.

So it will be 0.25, so if you calculate this one it will be something close to 154.06, so this will be you know calculate the amount of the interest which can be calculated based on the ordinary method. Now if we take the exact interest so exact interest you know in that you assume that the n is based on the exact number of dates, days in the year. So in this case Cv will be 8500, r will be same as 0.0725 and n will be 90 upon 365. So what we do is we calculate the exact interest.

Now in the ordinal interest we could like it as i0 and this is ie and ie will be 8500*0.0725*90 upon 365. So we get it here as 151.95. So this is how we calculate the ordinary interest and the exact interest whenever we have to calculate.

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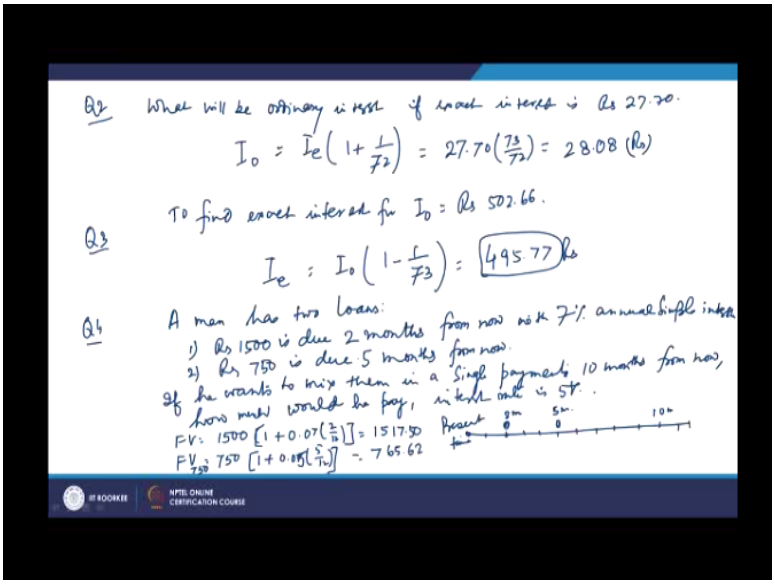

Next problem you will discuss question number 2, now question number 2 tells that what will be ordinary interest if exact interest is rupees 27.70. Now in such case when we know that you have to get exact interest I mean we have to calculate the ordinary interest and exact interest is to be calculated. So we know that there is rule for that and for that the rule is like this that ordinary interest will be exact interest that is ie*1+1/72.

So your exact interest is 27.70 and then it is multiplied by 1+1/72, so that is 73/72 and that becomes equal to 28.08. So that is how you know you can find the exact you know ordinary interest if the exact interest is known. Similarly there may be question in the you know just opposite way that your you have to find exact interest for ordinary interest=Rs. 502.66.

So if the ordinary interest is given and you have to find the exact interest, in that case you have to find again exact interest will be Io and it will be 1-1/73, so it will be something close to 495.77. So this way whenever you have to calculate these you know interest, so it will be 70, it was 73/72 it has become 72/73, so same thing is coming here and this is a score of that factor.

So this amount is the exact interest when the ordinary interest is given, next will discuss about other cases, suppose we are dealing with a case where a men has 2 loans and the loans are like this that in the first one your Rs. 1500 is due 2 months from now with 7% annual simple interest and there maybe the in the second part you know Rs. 750 is due in 5 months from now.

Now so what you wants to do is now if he wants to reach then in a single payment 10 months from now, so how much now in this case how much you know would he pay and interest rate is 5%, now in this case the thing is that this 1500 is due 2 months from now with 7% annual simple interest and 750 is due 5 months from now. So he has to you supposed he has to pay 10 months from now what will be amount he has to pay if the interest rate is 5%.

So for that what we do is now first of all you will find the future value now if you look at these you can have the diagram you know if you look at the diagrammatic representation this is the present time, so this is your present time so it is 0, now you have 1, 2, 3, 4 like that it is going 5, 6, 7, 8, 9 and 10 and you know 11 and 12, so something like that. Now his due is basically you know here second month 2 month from now.

And then he has so one point is this and then you have 5 month from now here so also that one now the thing is that if you find the future value at this point so for this point you have to calculate the future value. Similarly for this point also you have to calculate the future value and then actually you have to find at that particular interest or that interest given for the 10 months from now.

So if you look at the future value for the 1500 payment now future value for that payment will be 1500 and it will be current value and then into 1+rm, so it will be 1+r is you know 7% so 0.07 and n will be 2 months, so it will be 2/12, so this these are value for this 1500 and that comes out to be 1500 17.50 ok. So this is 2 months, this is 5 months and this is 10 months.

So you have to find here, now similarly if you try to find for the other values so for the 750 the future value will be 750*1+0.07 and then that will be basically you know 5/12, so that is to be taken into account. So this will be you know coming out to be 765.62. So that is what is coming for this. Now the thing is that for this 1517 value you have to find its value after 8 months.

Because this is going to be paid you have to calculate after 8 months so and then that basically that in rate of interest is a given as 5%. Similarly this 750 which has now gone to **76** 765.62 it has to be calculated for another 5 month at the rate of you know 5% and then that will be calculated. Now in this case what we have to see that there was a mistake in telling that once we know that this Rs. 750 basically is due in 5 months from now.

And there is no interest mentioned so now this 750 for 5 months this interest rate will be not seven but basically it will be 5 and then that will be coming out to be 765.62, so anyway for this 750 amount this is the direct amount that is to be paid. Now this amount corresponding to this 1500 its value is at this point of time. So again what we have to do is for another 8 months you have to calculate how much you have to pay taking the compounding interest into account at 5%.

So this 750 was basically not 7% for 7% was only for 1500 amount and this 750 was anyway due without any interest is not mentioned, so 750 due here and this will be due for another 5 months, so for that 5 months you are calculating at 5%, so 0.05. So what you have to do is for this 1500 you have to further find the future value. So for that FV for 1500 finally will be 1517 was there you know we calculated 1500 you know 17.50.

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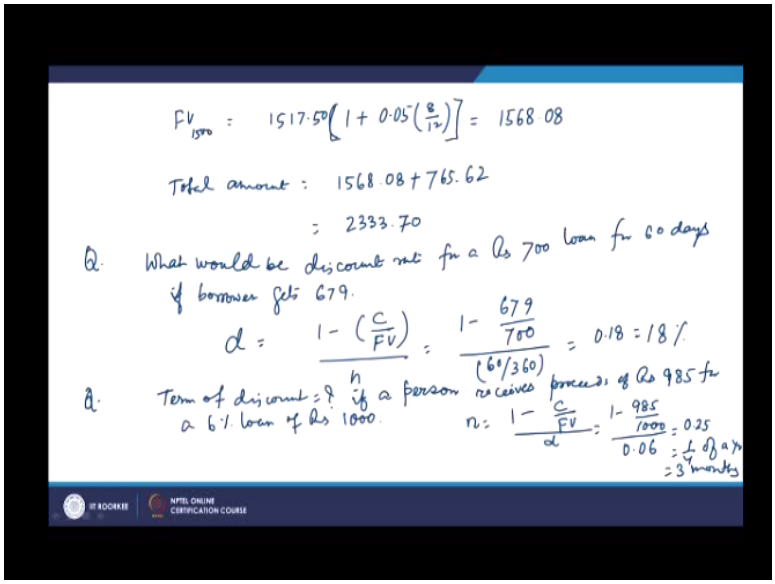

And it will be into 1+rn so r is now 0.05 because 7% was there only for 2 months after that it is 5%, so it will be 0.05 and then it has to be done for 8 months. So then only it becomes the 10th month and that comes out to be 1568.08. So ultimately you have the amount that is required it will be total amount which is payable, it will be for 1500 as well as for 750 and for 1500 it is 1568.08.

And for 750 it is coming as 765.62, so it will be 23 you know and 33.70, so this way we what we do is we calculate to take into account with you know compound interest which is being given and here you know that you have different rates of compound interest given for

different period. So that you have to take into account and then finally we have to calculate what amount is payable.

Next will be again we will be calculating another type of question and this question is related to the discount calculation, so the question is what would be discount rate for a Rs.700 loan for 60 days, if barrower gets 679, now in this case the barrower is getting 679 for a loan of Rs.700, so you have to find the discount rate and we know that how we calculate this discount rate. So discount rate is basically calculated as 1-C/FV.

And then that divided by n, so C that is 679 and FV future value was 700, so for 700 you know so it will be 1-679/700, and then he is getting the you know time of maturity is 60 days will be 60/360. So it will be 21/700* again you know here as 61, so it will be coming as 0.18 because it is coming 21*6/700, so 126/700 which is 0.18, so that is 18%, it means if the rate of discount is a you know 18%.

Then in that case the borrower will be getting 679 you know for a 700 rupees loan. Similar to that you may have the question like what would be the term of discount. So that term of discount you have to find you have the discount suppose you are given a question that you have to find the term of discount if a person receives proceeds of Rs. 985 for 6% loan of Rs. 1000.

Now such as the question suppose in that case you have to find the term of discount that is n, now again we can use the similar formula n will be here and d will be here, so you can find n as 1-C/FVC is the proceed and then divided by the discount rate. So you will have 1-985 upon 1000 and divided by discount rate is 6%. So it will be 0.06. So it will be 15 by now 1000 and in into so that will be 6 here.

So it is coming as 0.25, so you can see that in this case 0.06 will be downwards 15/1000*1/0.06 so it will be 100, so 1500/6*1000, so it will ¼. So 0.25 and that is why it is 1/4(year) a year that is 3 months so in the maturity time is given as 3 months in that case you can say that this person will receive a proceed of Rs. 985 for a 6% loan of Rs.1,000. Next we can further see a problem.

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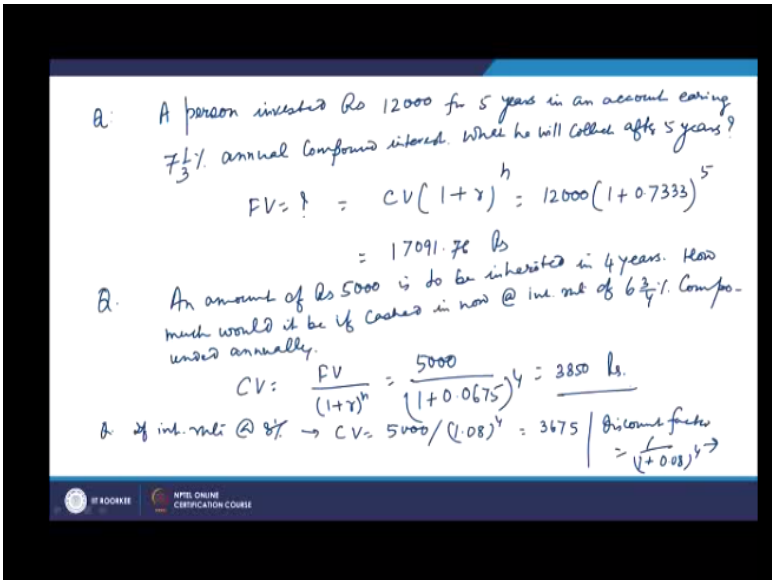

And this problem is basically on the investment, so a person invested Rs. 12000 for 5 years in an account earning you know 7 1/3% annual compound interest. So we are dealing with the compound interest problems, so what you will collect after what he will collect after 5 years. So now this is a problem of simple compound interest where the compounding you know done at the rate of 7 1/3% per annum.

And time is given as 5, so we know that the we are going to calculate future value and basically that will be CV*1+r raised to the power n. So r is the rate of compounding interest annually and n is 5 so that is compounding period number of compounding periods are 5. So it will be 12000 and multiplied by 1+ rate of integers so it will be 0.7333 and then raise to the power 5.

And if you calculate that it will be 17091.76, so this way you will be able to calculate the amount he will be receiving at the end of 5 years, you may have you know another question which will be opposite to it which will be contrary to it that you know an amount of Rs. 5000 is to be inherited in 4 years suppose now how much it would it be if cashed in now at interest rate of you know 6 3/4% compounded annually.

So such may be the questions in that case what is there that it you will get you know Rs. 5000 after 4 years, now if you want to cash it now I mean been before 4 years so what you will be getting so it means you are going to get calculate the current value and current value basically the future value is given n and r both are given, so in that case it will be future value divided

by 1+r raised to the power n. So it will be you know 5000/1+0.0675 and n raise to the power 4.

So if you calculate it you will be getting something close to a 3850, so this is how you calculate you know the value of the you know future value or current value you may be dealing with certain cases, now in this case if suppose you are increasing the you know interest rate to 8% so interest rate if it is increased now in this case only if you know interest rate is at the rate of 8%.

In that case what will be your you know current value and that current value will be again 5000/so the current value will be 5000/1.08 raised to the power 4. So that way you have to calculate and then it will be coming close to 3675. So basically that will be question you can have a situation where if you are maybe so that this amount is known so what will be the you know rate of interest compounding interest.

So how much that also can be you know found out and also you can have the discount factor in supposes cases so discount factor will be 1/1+08 raise to the power 4. So that will be the discount factor, discount factor is to multiply you know with that V the future values that will give you the current value. So that way you can calculate these values you may have extend s that may be the situation where the number of years are different.

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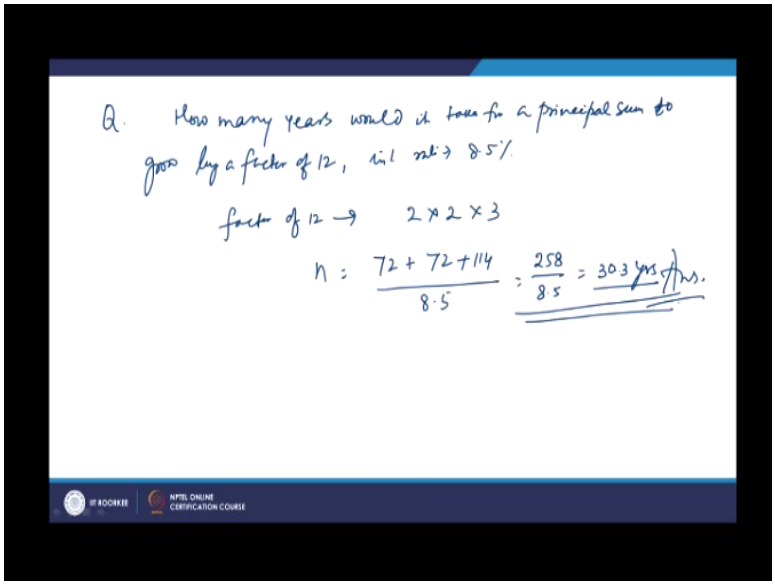

And the rate of interest is same so that also can we change so here that time will be changing and you can find the different values, lastly we will also deal we dealt with some questions

related to the growing of our investment amount. So suppose you are told that how many years would it take for a principal sum to grow you know by a factor of 12. So that interest rate is 8.5%.

So in such cases what we know that if we have to increase you know by factor of 12 you know that we are to going to calculate first of all the factor of 12, so we know that it is 2*2*3 then we are going to have the n as for the 2 it is 72, for 2 again 72 and for 3 it is 114 and this will be divided by the you know interest rate so that is 8.5. So you will have 258/8.5 so that comes out to be 30.3 years.

So this problem we have seen we have discussed that in how many years you know the amount will be going to a certain factor will multiplied with certain factor. So this can be calculated for in any years supposing 12 years so it will be something like 21.5 years. So for 21 I mean if this 12% in that it will be 21.5 years or so. So this way you can solve these problems, you can practice more and more questions based on that, thank you very much.