Economics, Management and Entrepreneurship
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Lecture - 27
Exercises

Good morning. Welcome to the 27th lecture on Economics, Management and Entrepreneurship. In the last 26 lectures, we had discussed about various topics on microeconomics, engineering economics, costing and accounting. In the last few lectures, we talked about engineering economics in great detail using time value of money and in the last 2 lectures we discussed on accounting for depreciation.

As we were doing earlier, we shall take up a few examples to complete our discussion on various topics on economics. After this lecture we shall be discussing on various topics on management and how they are applied to the particular profession of entrepreneurship. So today we shall revise our memory and try to solve some exercises.

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Exercise 22

Ashok Furniture Mart plans inventory levels (at cost) at the end of each month as follows:

May: 250,000 Rs, June: 220,000 Rs

Sales are: June: 440,000 Rs

COGS = 80 % Sales

Purchase in April and May were 250,000 Rs and 180,000 Rs

A purchase is made at cash 10 % the same month, 80 % after 1 month, and 10 % after two months.

Prepare the budget schedules for June for purchase and for disbursements for purchases.

First we take a problem on Budgeting that we have done some 5 or 6 lectures ago. This is a very simple problem. Ashok Furniture Mart plans inventory levels at the end of each month. And for 2 months the desired inventory levels are given. For the month of May, it is 250,000 Rs and for

June it is 220,000 Rs. Sales for June are given as 440,000 Rs. Cost of goods sold is usually 80% of the sales. Purchases in April and May were 250,000 Rs and 180,000 Rs.

A purchase is made at cash 10% the same month, 80% after 1 month, and 10% after 2 months. The problem is to prepare the budget schedules for June for purchase and for disbursements for purchases. Now these are desired inventory levels for May and June. June sales data are given. Cost of goods sold given. Purchases in April and May are given not for June. And this (()) (03:51) says that when a purchase is made 10% of the amount is given in cash and 90% given later. 80% after one month, 10% after 2 months.

So we are required to find out for June how much to purchase and actual cash disbursement for purchases.

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	April	May	June
Purchases Budget			
Sales (given)			440,000
COGS (= 80 % of sales)			352,000
Desired end inventory (Given)		250,000	220,000
Purchases	250,000	180,000	322,000*

	April	May	June
Disbursements for Purchases			
10 % of purchases made 2 years ago			25,000
80 % of last month's purchases			144,000
10 % of this month's purchase			32,200
			201,200

*250,000 + Purchase in June – 352,000 = 220,000.
Hence, Purchase in June = 322,000 Rs

So we prepare first of all the budget for purchase and the budget for cash disbursement. Now given are April and May figures of purchases. Also given the sales data for June, and we know 80% of sales is cost of goods sold therefore 80% of 440,000 comes to 352,000. The Desired end inventory are given here. Now from this, we can find out the amount to be purchased in June. How? Because whatever we are left with at the end of May + the amount to be purchased in June – this June end inventory.

So 250,000 is the amount that we are left with at the end of May + whatever we purchase in June from there we will sell 350,000, this is the cost of goods sold the actual inventory will be depleted by this amount, although we are selling at higher price and thereby getting some profit. The cost of goods sold is 352,000. So after we subtract this we should be left with 220,000 because that is desired. At the end of June, we should have this.

By solving this we get purchase in June should be = 322,000 Rs. So this how the June purchases is budgeted for. And of course similarly, one can if the values are given for July, August we can also find out the purchases to be made for the months of July and August. Now the Disbursement, it says that whenever we make a purchase 10% of that we pay in cash, so this month it is 322,000 amount purchased, cash purchase is just about 10% which is 32,200 Rs.

Remaining is credit. But the purchases made one month ago 80% of that amount has to be paid now. So purchase month ago was 180,000 Rs. 80% of that comes to 144,000 Rs. And purchase made 2 years ago 10% of that has to be paid now, so 25,000 Rs is to be paid now because in April gross 250,000 Rs. if you add them up we get the amount cash that has to be cash disbursement to be made in the month of June.

So this is the solution for exercise, the last exercise. Okay now for this problem, now we have found out the amount to be purchase, this is the budget that purchased and this is the budget that cash outflow on account of purchases.

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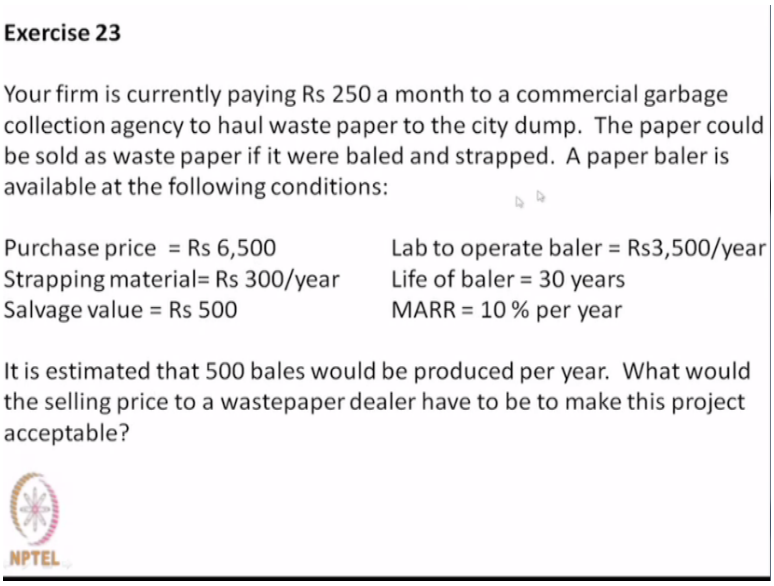

Now we take another problem another exercise. Your firm is currently Rs 250 a month to a commercial garbage collection agency to haul waste paper to the city dump. So basically waste papers are dumped into a particular place and agency has been deployed to carry the wastepaper to that place by paying Rs 250 a month. Now there is an alternative. The paper could be sold as wastepaper if it were baled and strapped.

If it is properly baled and strapped, then they can be sold at a price. A paper baler is available at the following with the following values. If you buy a paper baler the price Rs 6,500. To operate that baler, you need some labor and that cost is Rs 3,500 a year. You have to also need the strapping material and your estimate is that it is Rs 300 per year. A baler if purchased will have a life of useful life of about 30 years and it can be sold at a value of Salvage value of Rs 500.

And the Minimum Attractive Rate of Return at 10% per year can be taken. It is estimated that in a year 500 bales can be prepared, that is your waste paper volume is such that you can make 500 bales. What would the selling price to a wastepaper dealer have to be to make this project acceptable? So because you have to sell this bale at a price P, what should be their price P be so that this alternative is economical viable?

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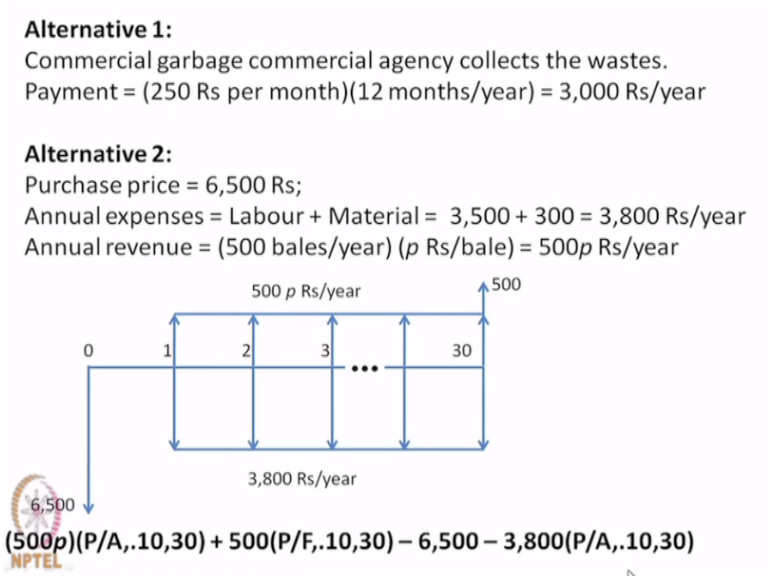

Now, so we have 2 alternatives. In the first alternative we pay an amount of Rs 250 to the collection agency, and the second alternative is that we can buy a machine, use a labor so there is a labor cost, there is a procurement cost, there is a material cost but we can sell the bale, the estimated number of bales is known as 500. So this is what we are trying to write down here. Alternative 1, Commercial garbage agency collects the wastes. Payment we make is 250 Rs per month and 12 months a year that comes to Rs 3000 per year.

The second Alternative has got these values. Purchase price is 6,500. And annual expenses is Labour + Material, Labour per year is 3,500, material is 300, total 3,800 Rs per year. Annual Revenue, suppose that every bale price is priced at Rs. P, 500 bales per years * P Rs per bale is 500p Rs per year. Now we show this in the form of a figure, the second alternative. This is a cash outflow 6,500 and the annual expenses for 30years at the rate of 3,800, this one 3,800.

The revenues are 500*p, p is the unit price of the bale, 500 bales per year. And then finally the salvage value of 500 Rs at which the baler can be sold out. So this is the cash flow diagram. So what we do, 500 p is the annuity so we find out the present worth of this Equal-Payment-Series. So 500 p multiplied by P given A Equal-Payment Series Present worth factor. 10% MARR 30 years + the salvage value 500, this is a single payment. Find out its present worth.

So single payment present worth factor 10% 30years. And now we subtract from their 6,500 just the initial investment and also subtract the present worth of all the expenses, annual expenses. So this is the Equal-Payment Series present worth factor multiplied by 3,800, so you show this as 3,800 * Equal-Payment Series Present worth factor, this amount should be > or = the amount that Alternative 1 (()) (15:24), this amount is 300, 3000 Rs per year.

So 3000 per year is the cost here. And this amount, this is in fact if you write this as this is a cost and this cost should be low, in fact we should write it in a different way. We should write that the cost should be less because this is the cost to us and if this is the this could be positive or this may not be positive therefore we should not write this as > or =, we should write this would be compared with 3000. So this value should be compared with 3000.

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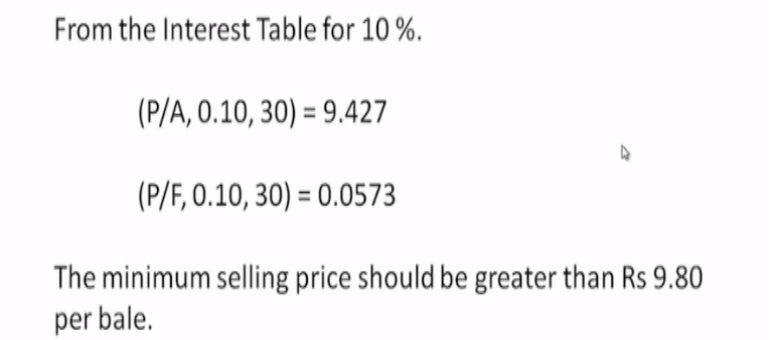

Now from the Interest Table for 10% we see that P of A, there is a mistake here, P given A is 9.427 and P given F is 0.0573 from 10% Interest Table we find out the Equal-Payment Series present worth factor and single payment present worth factor and use this values here and then we compare this value with 3000 and we see that if the selling price is > Rs 9.80 then our, then this will be better it will give us profit over or it will be more economically viable compared to the alternative 1.

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Exercise 24

A construction company is going to purchase several light-duty material-handling equipment. Its MARR before taxes is 20 %. It is considering two makes, and the following relevant data are available.

	Make A	Make B
Investment	Rs 100,000	Rs 150,000
Salvage value	20,000	30,000
Annual out-of-pocket costs	40,000	30,000
Useful life	3	5

What type of equipment should be purchased?

Now we take up another problem. This is a problem of a construction company which is going to purchase several light-duty material-handling equipment. Its MARR before taxes is 20%. And it is considering equipment of 2 makes, Make A and Make B. And the following relevant data have been obtained. Make A gives an investment, requires an investment of Rs 100,000. Make B 150,000.

The salvage value is 20,00 for Make A, 30,000 for Make B. And Annual out-of-pocket expenses are 40,000 and 30,000 respectively. But their Useful life are different, 3 and 5. What type of equipment should be purchased? Now this is a clear case of comparison between alternatives. Here one thing to notice is that Useful life's are different. So here we have 2 choices, the first choice is Equivalent Annual Cost method and the second choice is applying present worth cost comparison method. But there you have to make certain assumption.

If we recall the assumption is one of repeatability or C-terminus assumptions. First we study the Equivalent Annual Cost comparison method.

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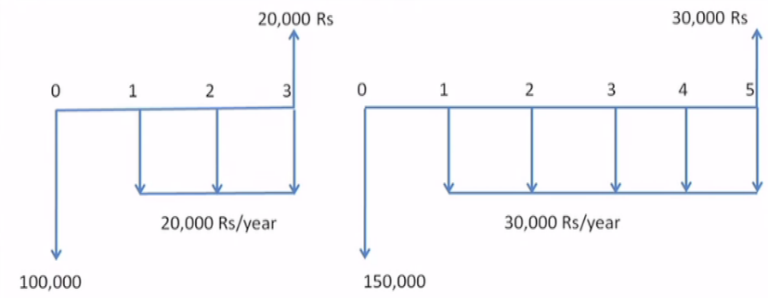

EAC_A = 100,000(A/P, 0.20, 3) + 20,000 - 20,000(A/F, 0.20, 3)
= 100,000(0.4747) + 20,000 – 20,000(0.2747)
= 47,470 + 20,000 – 5,594 = Rs 61,876

EAC_B = 150,000(A/P, 0.20, 5) + 30,000 - 30,000(A/F, 0.20, 5)
= 150,000(0.3344) + 30,000 – 30,000(0.1344)
= 50,160 + 30,000 – 4032 = 76,128 Rs

Make A is less costly than Make B.

In the Equivalent Annual Cost comparison method these are the 2 cash flow diagrams for Make A and Make B. For Make A the initial investment is 100,000, salvage value is 20,000, so it gets as a positive cash flow, this is negative cash flow and annual expenses are 20,000 Rs per year. For Make B, initial investment 150,000 5years and not 3 years, salvage value is 30,000, annual expenses 30,000. So what we do here is to find out the equivalent annual cost.

That means we first find out the equivalent to this to A, equivalent to this as A or annuity and then also take this into consideration. So for this we find out the-- what is this factor called Capital Recovery factor. We have invested this amount, what is the capital recovery factor A given P 0. -- this is taken as 20% and 3 years and then +20,000, this one – you find out the equivalent annuity. This is the sinking fund factor 20,000 multiplied by A given F, sinking fund factor for 3 years.

So this quantity from the Interest Table I got this value 0.4747 and of this value of 0.2747. And then EAC- Equivalent Annual Cost for Make A is obtained as 61,876 Rs. Then I also do the similar calculations for Make B, 150,000*capital rectory factor+30,000-30,000*sinking fund factor. But in this case the number of years is not 3 but 5. So I look at the 20% table but N was 5. The values obtained were 0.3344 and 0.1344.

Hence, the equivalent annual cost will be equal to this + this – this which comes to 76,128 Rs. and this quantity is lower than this. This is a cost therefore; Make A alternative is less costly compare to Make B alternatives. Now this how Equivalent Annual Cost comparison method is applied. Now if we apply the Present Worth Cost Comparison method then as I said there are 2 ways one is assumption of repeatability, repeatability means after the project is completed it will be repeated again.

So the first project which is of 3 years' duration we hall assume that it will be repeated 5 times. So that the total number of years we have is 3*5 which is 15 years. And the second project that is second alternative will be repeated 3 times, it has got a life of 5 years, when repeated 3 times it will be 15 years and therefore they will of the same number of years. So which means that--

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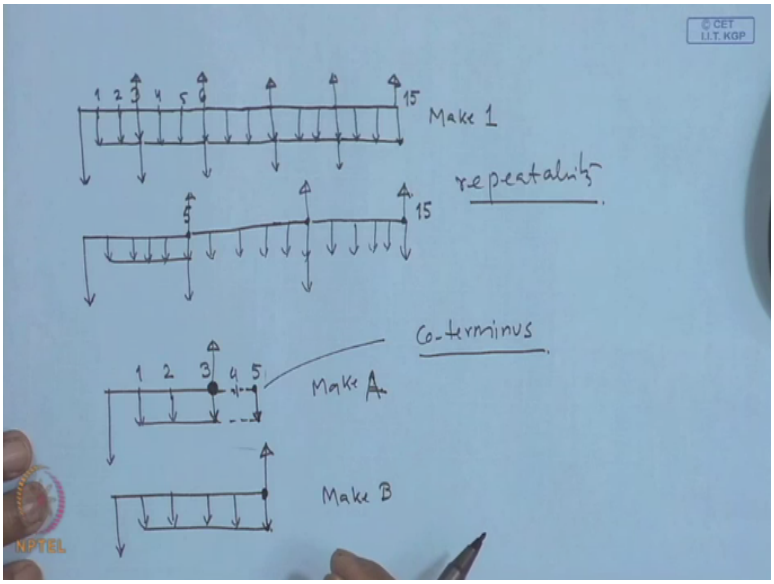

The first one, suppose this is 3, 1,2,3 then this will be continued this project will continue 2 times, this is 3 times, this is 4 times, this is 5 times. So this project whatever the nature of the, this is the first time it will be once this will continue second time and once again will be continued for the third time, 4th time and lastly fifth time. This is for Make A. Make B, this is the fifth time, 5 years, 15 years--10 years and then lastly 15 years. So similarly we have, it will be repeated again.

It will be repeated for the third time also, so that the number of years is the same. So this is how present worth method can be applied by assuming repeatable, making reparability assumption. The other way is this, that suppose if first one whatever the amount charged comes here as a final sum this will be assumed to be reinvested for the next 2 years. So this is Make 1 and this is Make A, and this is Make B. So here we make Co-terminus assumption.

Meaning we say that whatever amount is found out here at the end of the third year will be reinvested so that we find out its equivalent at the end of the fifth year and this final sum will be compared with the total amount that is coming here as equivalent at the end of the fifth year. So if we have to use the present worth cost comparison method there are 2 ways of doing it.

One is make a repeatability assumption so that the number of years is equal and that can be found out by taking LCM of the number of years of the 2 project and then apply a Present worth. Else what you do, we assume that after the end of this smaller duration project that amount will be reinvested for some more years so that the number of years for both the alternatives is the same and then find out the present worth.

So these are the 2 approaches, but however we can always use the Equivalent Annual Cost comparison method. Next we take up another problem.

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Exercise 25

Gopal wants to start a small business by investing Rs 500,000. He estimates that the revenues and expenses in the 10 years of the business will be Rs 1,000,000 and Rs 400,000. After 10 years he will wind up the business and is likely to get back Rs 200,000 by selling all the assets of the business.

Use the IRR and the ERR methods to find the economic feasibility of the proposal. Use MARR = 18 %.

Gopal wants to start a small business by investing Rs 500,000. He estimates that the revenues and expenses in the 10 years of the business will be Rs 1,000,000 and 400,000 respectively. After 10 years he hopes to wind up the business and is likely to get back Rs 200,000 by selling all the assets of the business. Use the Internal Rate of Return and the External Rate of Return methods to find the economic feasibility of the proposal. Use MARR as = 18%.

So what is it saying? It is saying that it is investing an amount of Rs 500,000 and that the business will last of 10 years. And the revenues and expenses are given every year. And he is likely to get back Rs 200,000 when he winds up his business after 10 years.

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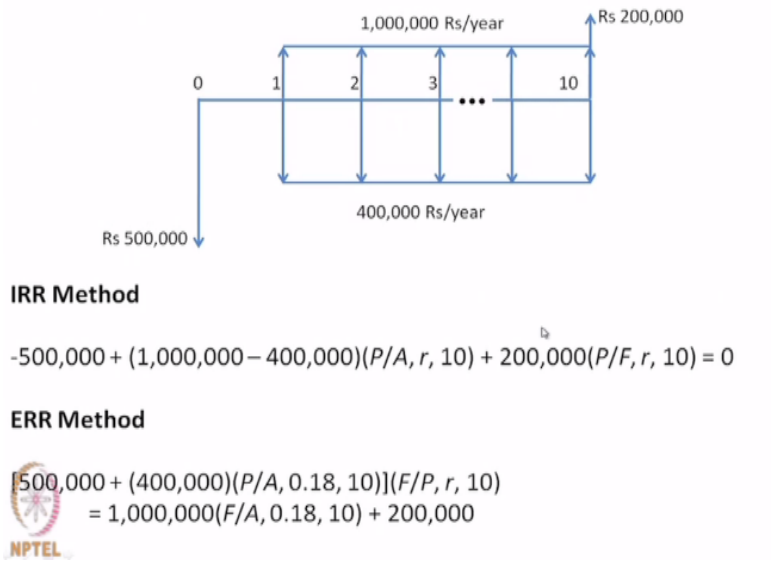

So this is the situation. Cash flow diagram. Initial Investment 500,000. Ever years the revenues are 1,000,000 but the expenses are 400,000. And he gets back 200,000 at the end of 10 years. So these are revenues. These are expenses. This is the initial investment. Now if we apply the Internal Rate of Return method it says that the R that rate of rate at which the present worth of all cash flows = 0 is a value of IRR.

This being an out flow to right here as -500,000 and these are revenues inflows so +, but this – therefore this is -, so 1,000,000 – 400,000. This find out its present worth P at a value R, we do not know the value R. We have to determine the value of R, but we know the number of years

10. And then + this is cash inflow + 200,000 single payments present worth factor. This is Equal-Payment Series present worth factor. This quantity should be = 0.

So here one has to use a Trial & Error method. If you have the Interest Tables for different values of R you see where it is close to 0, somewhere it will be negative, somewhere it will be positive. So those Interest Rate you take interpolate and find out the value of R. If that R is higher than MARR, accept the project. If it is lower than MARR do not take up that project. And MARR value is given as = 18%.

Now what is External Rate of Return method? Here what we do, all expenses are first of all discounted to the present. All revenues are compounded at the end of the final month, that is what is done here, 500,000 + all the expenses, so in this case 400,000 are discounted to the present at MARR 18%. And they are now invested at an external rate of return R which we do not know that is ERR.

So after this is discounted to the present Equal-Payment Series present worth factor this you can get from the table 18% table multiply that with 400,000 add to that 500,000. This amount suppose it is reinvested externally at a rate R that should be = the compounded amount here. So the compounded amount factor is multiplied with this value and that is = 100,000 multiplied by Equal-Payment Series compound amount factor + 200,000 that we are having here.

So here everything is known, there is no question of trial and error. If you have the values of this P/A and F/A you can multiply and you can directly find out the value of R.

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Exercise 26

A 10-year bond of Rs 1,000,000 is issued in 10,000 units, paying 10 % nominal interest in semi-annual payments. A sinking fund is created that earns 8 % compounded semi-annually to pay back the dues.

Find the semi-annual payment to the sinking fund.

Find also the annual payments made towards payment of interest and creation of the sinking fund.

Now we take yet another problem. This problem is the problem of a bond. A 10-year bond of Rs 1,000,000 is issued in 10,000 units. If you recall a company can get money to invest in 2 forms basically, one to get in the form of by selling shares that means the real owners of the company either common stock or preference stocks. Another way is to get loan long term loan which are called bonds or debentures. And this is that particular problem that we are taking.

A 10-year bond of Rs 1,000,000 is issued in 10,000 units, paying 10% nominal interest in semi-annual payments. It means that every bondholder will get 10% interest but semi-annually, that means twice a year. And how does this company, a bond interest is paid every half year, but the bond amount the actual face value will be paid at the end of 10 years, that is the meaning of bonds. Now how does the company make this payment?

The company actually creates a sinking fund so that at the end of 10 years it has the ability to make that payment. Interest payments are less but this 1,000,000 Rs loan that the company has taken from its bondholders that maybe difficult to pay at the end of 10 years unless it has created a fund and that fund is called the sinking fund.

And suppose the sinking fund is created which earns 8% compounded semi-annually to pay back the dues, then what is the payment to the sinking fund, by how much the company should pay to

the sinking fund that earns 8% interest so that it pays back the interest on the bonds semi-annually and also pays back the principal at the end of 10 years, this is the question.

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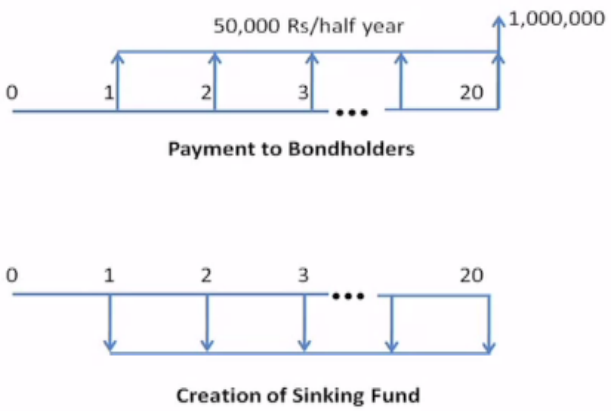

Now there are 2 cash flows involved here. One is payment to the bondholders, the other is payment to the sinking fund. Payment is made every year, in fact every half a year, this 20 is not a year it is periods. 10 years is equivalent to 20 interest periods because interest is paid every half a year, so 20 is the interest periods. Every interest period interest is paid how much, interest is paid 10% interest is paid. Now 10% interest half a year is 5%.

So 5% of 1,000,000 comes to 50,000 Rs. So it is 50,000 Rs per half a year or 50,000 Rs per interest period, it is a same thing. And there are 20 interest periods. And at the end the face value of the bond has to be paid back which is 1,000,000 Rs. So the cash flow to the bondholders is this. Now when we consider the sinking fund to be able to make this payment the company has to create a fund and that is the sinking fund by giving certain amount and we are required to find out this amount. Okay.

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Number of interest periods= 2 x 10 = 20

Interest per period = 8/2 = 4 % per period

The final sum of the sinking fund = F = 1,000,000 Rs.

The payment to the sinking fund per period = A
= 1,000,000(A/F, 0.04, 20) = 1,000,000(0.03358) = 33,580 Rs

Semi-annual interest paid to the bondholder
= 1,000,000 (0.10/2) = 50,000 Rs

Total payment (both to the sinking fund and to the bondholder)
= 33,580 + 50,000 = 83,580 Rs per period

Total payment in the 10 years = payment in 20 periods
= 83,580 x 20 = 1,671,600 Rs

Now to solve this problem we have first of all the number of interest periods, 2 in a year, 10 years therefore, 20 interest periods. Now for the Sinking fund the only 8% interest is given, so per period it is 4%. The final sum of the sinking fund has to be 1,000,000 Rs. So we have to use the sinking fund. 20 interest periods and in every interest period 4% interest. So the single payment sinking fund factor at a 4% interest on 20 interest period is obtained as 0.033588.

Multiply that with the final sum that will give the annuity which is 33,580 Rs. So this is the amount to be paid to the sinking fund in every period for 20 years at a 8% interest rate to be able to get 1,000,000 Rs at the end of 10 years. Now, the Semi-annual interest paid to the bondholder is bondholder is paid at a rate of 10% per year, so for half the year it is 5%. 5% of 1,000,000 Rs is 50,000 Rs. So this is the semi-annual interest paid to the bondholder.

And therefore, the total payment is both to the sinking fund and to the bondholder every period. To the sinking fund the amount is 33,580 Rs and to the bondholder it is 50,000. Therefore, the company pays a total of 83,580 Rs per period. And in 10 years that is in 20 periods the total amount the company pays arithmetic sum is 1,671,600 Rs. So this is an exercise.

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Exercise 27

A company purchased a machine for Rs 150,000. It paid shipping costs of Rs 10,000 and nonrecurring installation costs amounting to Rs 12,000. At the end of 3 years, the company had no further use for the machine; so it spent Rs 5,000 for having the machine dismantled and was able to sell the machine for Rs. 15,000.

Use straight-line, sum-of-the-years-digits, and double-declining-balance (with switchover to st. line) methods to compute depreciations and book values.

And the last exercise we take is this. A company purchased a machine for Rs 150,000. It paid shipping costs of Rs 10,000 and nonrecurring installation costs amounting to Rs 12,000. At the end of 3 years, the company had no further use for the machine; so it spent Rs 5,000 for having the machine dismantled for having the machine and was able to sell the machine for Rs 150,000.

Use various methods to compute depreciations and book values. Already in the last class last lecture we had discussed this. The machine was purchased for Rs 150,000 but there are initial cost such as shipping cost and nonrecurring installation cost, therefore we will have to add these costs to the purchase price to find out our Adjusted cost basis. That is what we have done.

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Adjusted cost basis = 150,000 +10,000 + 12,000 = 172,000 Rs.
Recovery period = n = 3 years.
Net salvage value = 10,000 Rs.

St-Line Method

Depreciation = (172,000 – 10,000)/3 = 162,000/3 =54,000 Rs/year

Book values are:

BV1 = 118,000 Rs; BV2 = 64,000 Rs; BV3 = 10,000 Rs

Sum-of-the-years-digits Method

Depreciation are:

D1 = (3/(1+2+3)(162,000) = 81,000 Rs; D2 = 54,000 Rs;
D3 = 27,000 Rs/year

Book values are:

BV1 = 91,000 Rs; BV2 = 37,000 Rs; BV3 = 10,000 Rs

The Adjusted cost basis is the price + the shipping cost and the installation cost that comes to 172,000 Rs. The Recovery period is 3 years. And the company spent 5,000 Rs and sells it at 15,000 Rs at the end of years. Therefore, the net salvage value will be 15-5 that is 10 that is what we have written here. Now the Straight Line method of depreciation calculation are very simple, 172-10 that is 162/3 that comes to 54,000 per year.

And book values are at the end of the first years 172-54 and -54 and -54, so book values are 118, 64 and 10,000 Rs respectively. Now use Sum-of-the-years-digits. That is simple. 3 years remaining and 1+2+3 so 3/6 half of this is 81,000. This is 2/3 54,000 and this is 27,000 1/3. Book values are 172-this 91,000 – this 37,000 – this 10,000, so that is the sum-of-the-years-digit method.

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Adjusted cost basis = 150,000 +10,000 + 12,000 = 172,000 Rs.
Recovery period = n = 3 years.
Net salvage value = 10,000 Rs.

St-Line Method
Depreciation = (172,000 – 10,000)/3 = 162,000/3 =54,000 Rs/year

Book values are:
BV1 = 118,000 Rs; BV2 = 64,000 Rs; BV3 = 10,000 Rs

Sum-of-the-years-digits Method
Depreciation are:
D1 = (3/(1+2+3)(162,000) = 81,000 Rs; D2 = 54,000 Rs;
D3 = 27,000 Rs/year

Book values are:
BV1 = 91,000 Rs; BV2 = 37,000 Rs; BV3 = 10,000 Rs

Now for the Double-Declining-Balance Method. First of all, it is 3 years so 2/n, 2/; f=66.70%. So what we have to for every year we calculate Double-Declining-Balancer method and straight line depreciations. Double-Declining-Balance method 172-10*2/3 which comes to 108,000. Now depreciation in the first year according to straight-line is 54 already we have seen or you can first calculate 172-10/3 that comes to 54, so 54 is lower than this calculated by DDB.

So the higher of the 2 we take that is why it is selected. So what is the book value after the first year? It is 172-108 which is 64,000 Rs. On this basis we calculate year 2s depreciation. In the

second years, it is 64-10 the salvage value*2/3 that is the fraction. The amount comes to 36,000 Rs. And according to Straight line method it is 64-10/2 years remaining that is 27. 27 is < 36 therefore select 36. Therefore, the book value comes down from 64 to 28,000 after subtracting 36,000.

Finally, we come to Year 3. It is 28,000-10,000 which is 18,000*2/3, 2/3 is fraction that is = 12,000. And by Straight line it is 18,000, higher is 18,000 so select that. So we have switched over to straight line only in the last year to be able to get the salvage value of 10,000 at the end. So this is how we have used this Straight line method the Sum-of-the-years-Digits method and the Declining-Balanced method with switch over to Straight line method.

So in our, in this exercises that we covered today, we have seen problems on budgeting on simple interest rate calculation are considering time value of money. We compared the alternatives by Present worth method, by Equivalent Annual Cost Comparison method, by Internal Rate of Return method and by External Rate of Return method. Then, we also use an example to show how different methods of depreciation accounting can be used on a particular problem.

So with this we end our series of lectures on economics as relevant to the profession of entrepreneurship. From the next lecture onwards, we shall be discussing on the principles of management that are pertinent to entrepreneurship. Thank you very much.