Depreciation, Alternate Investment and Profitability Analysis.

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Lecture-5.

Depreciation Sum of the Digits Method.

Welcome to the course depreciation, alternate investment and profitability analysis. This is module one, depreciation. In this module, today I will cover a new depreciation method that is sum-of-the-digits method. The sum-of-the-digits method is an arbitrary process for determining depreciation which gives results similar to those obtained by the declining-balance method.

In this method, larger costs for depreciation are allotted during the early life years than during the later years. This method has the advantage of permitting the asset value, to decrease to zero and we have seen that this was not possible for declining-balance method and double declining-balance method. So, the asset value decreases to zero in this method or a given salvage value at the end of the service life. So, this method sum-of-the-digits method attains either zero salvage value or a given salvage value.

In the application of the sum-of-the-years-digit method, the annual depreciation is based on the number of service life years remaining and the sum of the arithmetic series of number from 1 to N, where N represents the total service life. This will be clear more clear when we will give the examples. The yearly depreciation factor is the number of useful service life years remaining divided by the sum of the arithmetic series. This factor times the total depreciable value at the start of the service life gives the annual depreciation cost.

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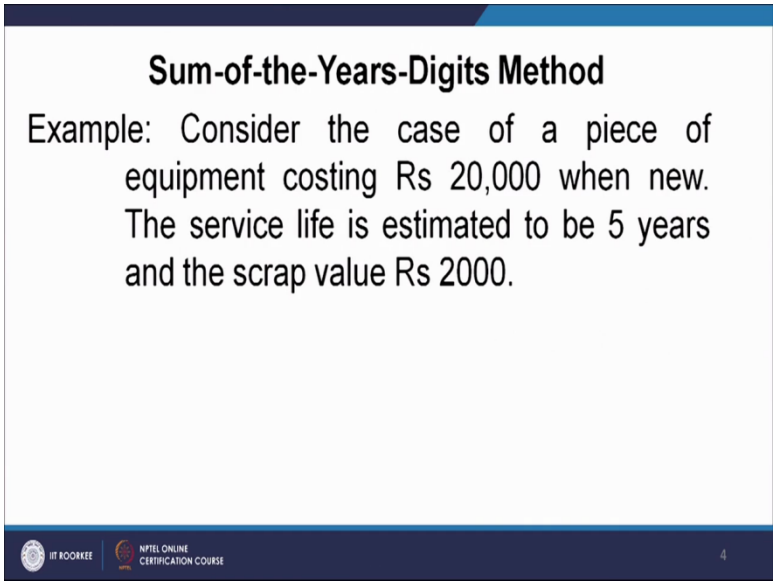

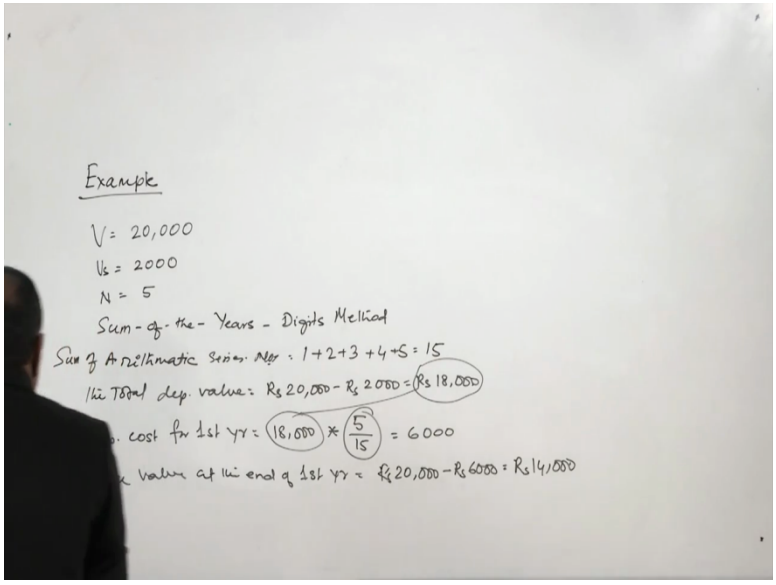

Now, sum-of-the-digits methods, let us introduce this method through an example. Consider the case of piece of equipment costing Rupees 20,000 when new. The service life is estimated to be 5 years and the scrap value Rupees 2000 that is salvage value is 2000, the original cost of the equipment is 20,000 and the service life is 5 years and let us apply sum-of-the-years-digit method on this. Our V is 20,000, Vs is 2000, N is equal to 5 years and we have to apply sum-of-the-years-digit method. So, method applied will be sum-of-the-years-digits method.

Now, we have to find out the arithmetic sum of the series. So, the N is 5, I will sum from 1 to N that is 1 + 2 + 3 + 4 + 5 and which comes out to be 15. Now, the total depreciable value is equal to Rupees 20,000 - Rupees 2000 equal to Rupees 18,000. So, now the depreciation cost for first year is equal to this 18,000 taken from here, into 5 by 15, comes out be 6000. Now,

and the book value at the end of first year is equal to Rupees 20,000 - Rupees 6000 equal to Rupees 14,000.

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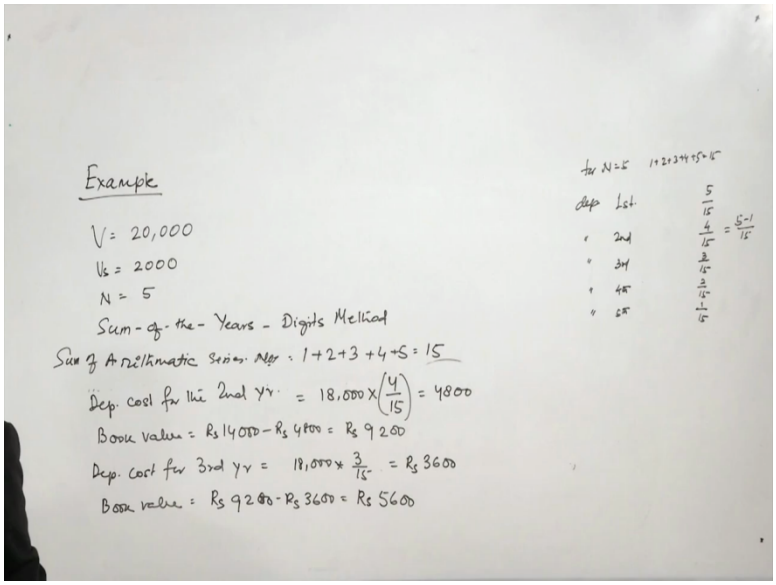

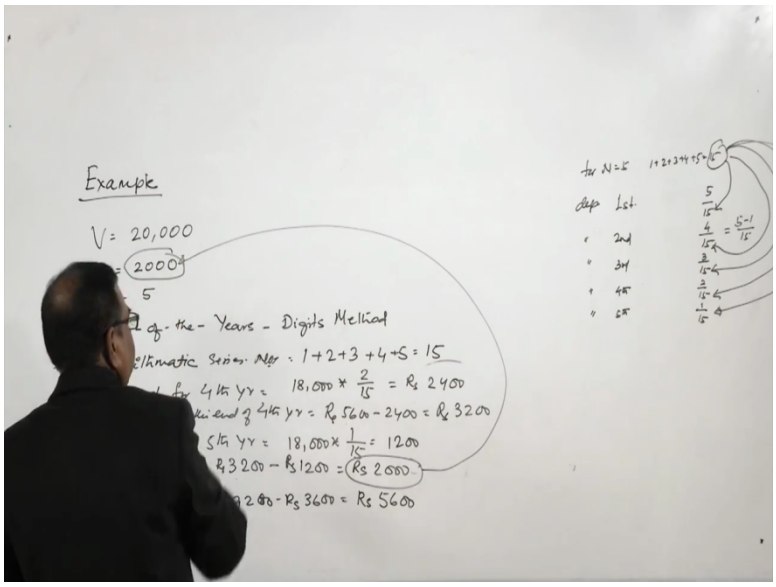

Now, the depreciation cost for the second year is equal to 18,000 into 4 by 15 is equal to 4800 and the book value will be the Rupees 14,000 - Rupees 4800 is equal to Rupees 9200. Now, the depreciation for first year we will have the multiplier 5 by 15 for N equal to 5 where 1 + 2 + 3 + 4 + 5 is equal to 15. Depreciation for the second year 1 will be decreased from here, 15, for third year this is 3 by 15, for fourth year this is 2 by 15 and for the fifth year this is 1 by 15. So, this is how the factors will be multiplied. So, for the second year here, we have decrease from 5 to 1, this is 5 - 1 divided by 15. Okay.

Now, deprecation cost for third year is equal to 18,000, this remains constant into 3 by 15, this comes out to be Rupees 3600. So, book value at the end of third year is equal to Rupees 9200 - 3600, it comes out to be Rupees 5600. So, we have already calculated book value at the end of third year and depreciation. So, depreciation cost for fourth year will be equal to Rupees 18,000 Rupees that the amount which has to be depreciated into fourth year, it is 2 by 15, this is the 15 which has come from here and this comes out to be Rupees 2400. So, book value at the end of fourth year will be this Rupees 5600 - 2400, which comes out to be Rupees 3200.

Now, depreciation cost for fifth year will be 18,000 into 1 by 15, which comes out to be Rupees 1200 and book value at the end of fifth year is equal to Rupees 5600 - Rupees 1200, no no sorry, this is 3200 not 56, this is 3200 - 1200, comes to be Rupees 2000. So, this 2000, matches with this 2000 that means the method has a capability to reduce to the salvage value. We have seen earlier that declining-balance method and the double declining-balance method, they do not reduce to the salvage value and by using this method we can reduce to the salvage value or even zero salvage value. So, this is the positive part of it, here also we will see that it reduces, it gives depreciation cost more in the early years and place in the later years.

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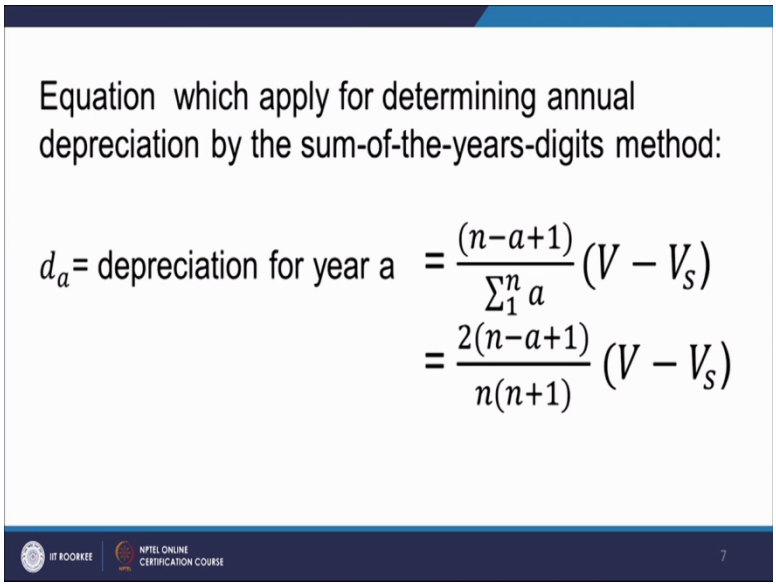

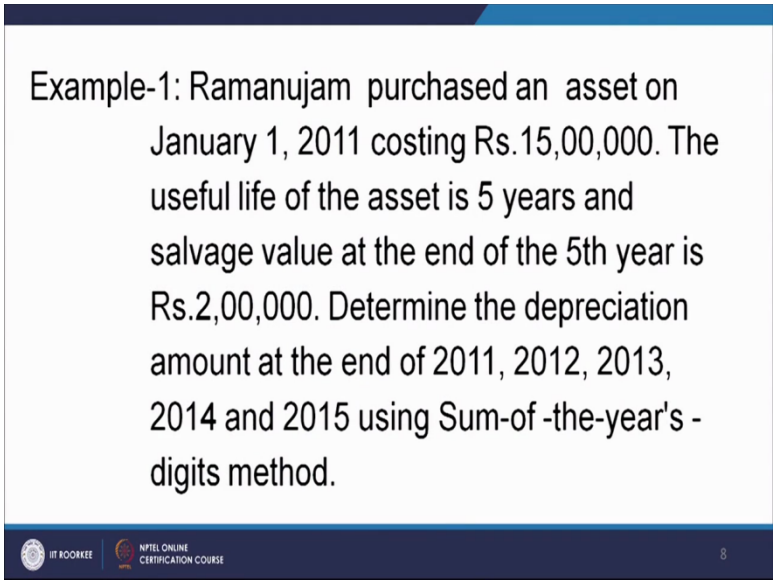

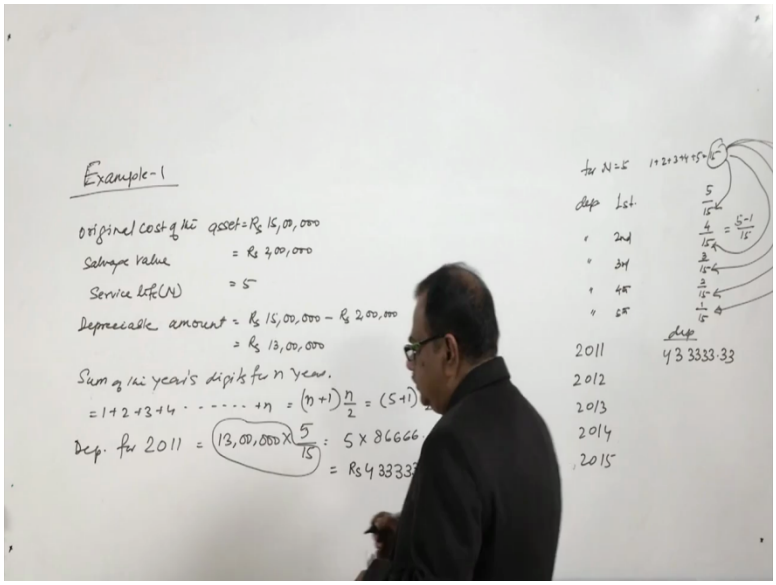

Now, after knowing this how the method works? Let us see something else. Now, you have seen that I have, to calculate depreciation for a year we can have a formula which is given below. So, you can directly find out depreciation for a particular year a. So, da is equal to 2 in the brackets n - a + 1 divided by n into n + 1 into V - Vs. Now, let us take example one. Now, the example one, Ramanujam purchased an asset on January 1, 2011 costing Rupees 15lakh. The useful life of the asset is 5 years and salvage value at the end of the fifth year is 2 lakh of Rupees. Determine depreciation amount at the end of 2011, 2012, 2013, 2014 and 2015 using sum-of-the-years-digit method.

Now, this is example one. Now, original cost of the asset 15,00,000, salvage value is equal to 2,00,000, service life equal to 5 years. Now, so depreciable amount is equal to Rupees 15,00,000 - Rupees 2,00,000 which comes to be Rupees 13,00,000, now we see the sum of

the years digits for N years that means if I take this, this comes out to be n + 1 divided by n by 2 and if I do this, this is 5 + 1 divided by 5 by 2. This comes out to be 15.

So, depreciation for 2011 will be 13,00,000 into 5 by 15 which comes out to be 5 into, now what I will do this is repeating. So, I calculate this. So, this is 86666.667 and if I multiply this, this comes out to be Rupees 433333.33. So, my depreciation for 2011 is this, 2011 depreciation charged is 433333.33, 2012, 2013, 2014, 2015.

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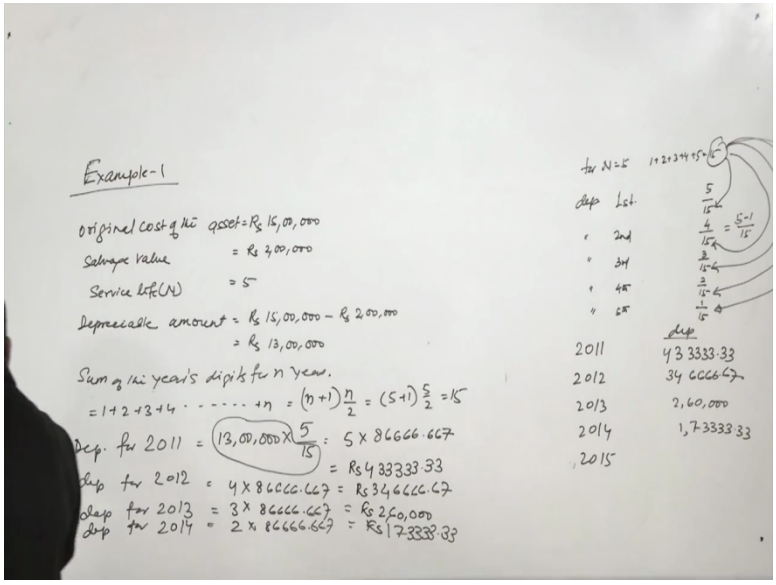

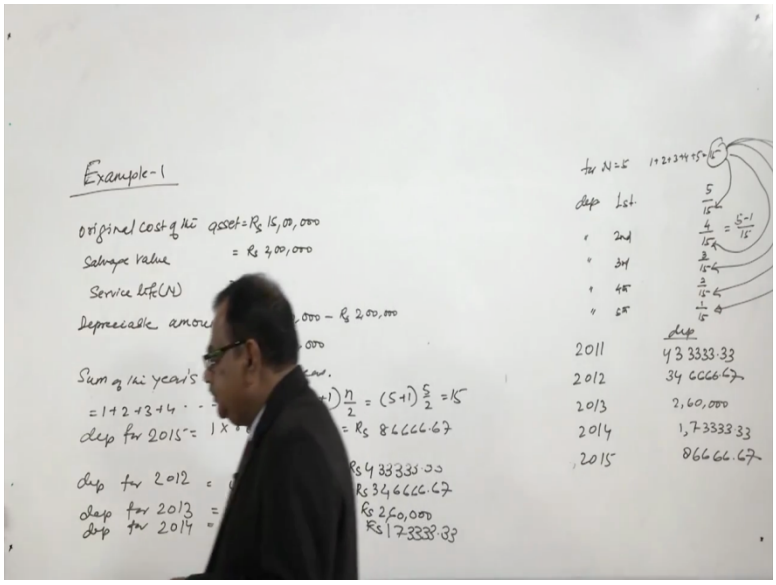

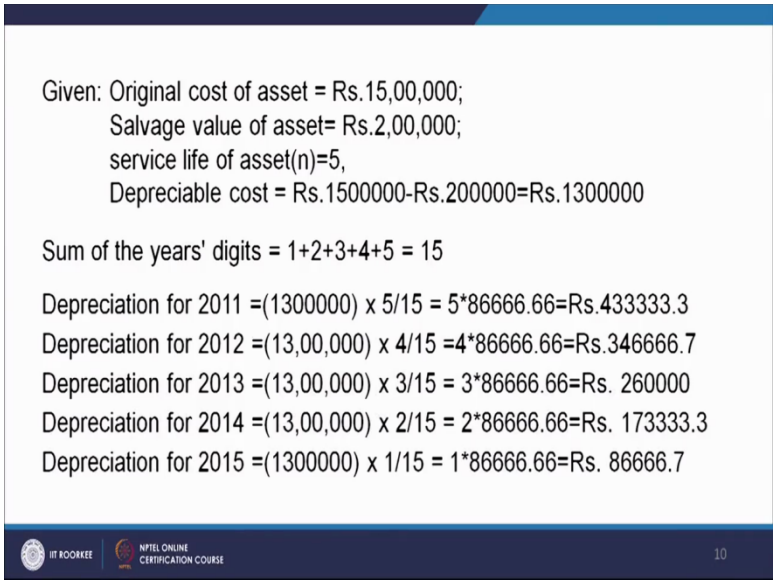

Now, for depreciation for 2012 is equal to 4 into 86666.667 this comes out to be Rupees 346666.67. So, my depreciation for this is 346666.67. Similarly, depreciation for 2013 is equal to 3 into 86666.667 comes out to be Rupees 2,60,000. So, it comes out to be 2,60,000. Now, for depreciation for 14 is equal to 2 into 86666.667 comes out to be Rupees 173333.33, 173333.33 and if we compute depreciation for 2015, this is 1 into 86666.667, this is Rupees 86666.667. So, 86666.667.

Now, from here we see that this does not decrease linearly in the early years the decrease is rapid than the later years. So, these are the results. So, we can see here which I have computed. Now, let us see example number two. Now, one thing here we should the understand that in the first year the depreciation is maximum. This we should remember because in one of the problems we have to use this trick.

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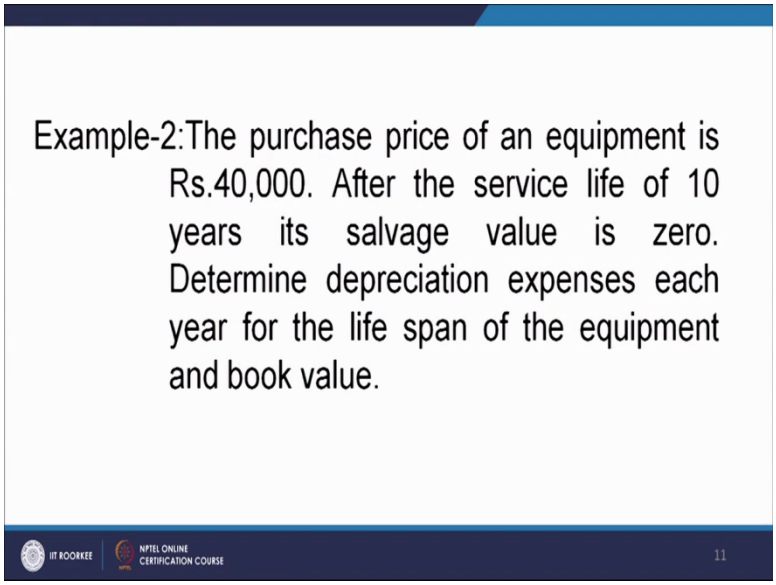

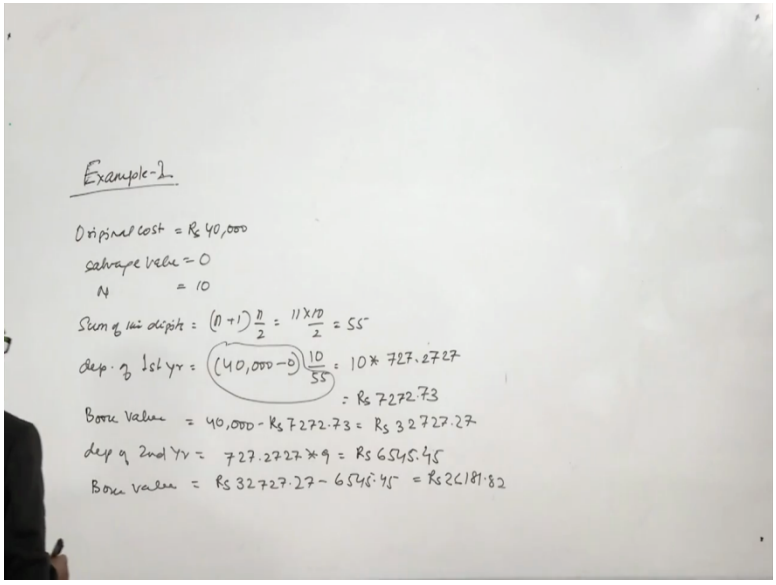

Now, the example number two, it says the purchase price of equipment is 40,000. After the service life of 10 years, its salvage value is zero. Determine depreciation expenses each year for the life span of the equipment and book value. Now, here it shows because in the problem through this problem I want to show you that you can decrease the salvage value up to zero using this technique.

Now, the original cost of equipment or asset is Rupees 40,000, salvage value equal to zero, N is equal to 10 years and we all know the sum of the digit equal to n + one into n by 2, this is 11 into 10 divided by 2 which comes out to be 55. So, depreciation of first year, equal to 40,000 - zero into 10 by 55, comes out to be 10 into 727.2727 comes out to be Rupees

7272.73. So, what I have done I have, this is fixed value so it has been converted into a fix value that is 727.2727.

Now, book value will be at the end of the first year, will be 40,000, depreciation of this first year 7272.73 is equal to Rupees 32727.27. Now, depreciation of second year will be this value 727.2727 into 9 that is 10 - 1 is 9, comes out to be Rupees 6545.45. So, the book value at the end of second year, Rupees 32727.27 - 6545.45 is comes out to be Rupees 26181.82.

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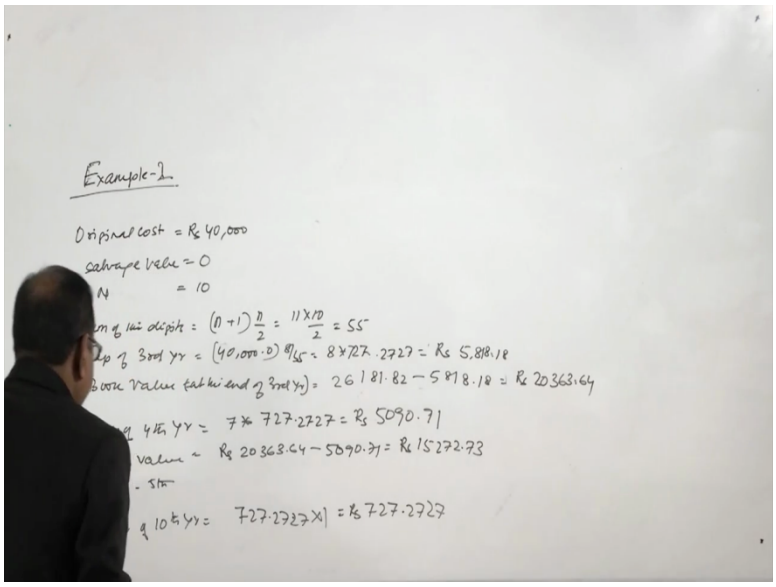

Purchase price			40,000.00
Salvage value			0.00
Depreciable value			40,000.00
Life (in years)			10.00
Year	Depreciation Expense	Accumulated Depreciation	Book Value
1	7,272.73	7,272.73	32,727.27
2	6,545.45	13,818.18	26,181.82
3	5,818.18	19,636.36	20,363.64
4	5,090.91	24,727.27	15,272.73
5	4,363.64	29,090.91	10,909.09
6	3,636.36	32,727.27	7,272.73
7	2,909.09	35,636.36	4,363.64
8	2,181.82	37,818.18	2,181.82
9	1,454.55	39,272.73	727.27
10	727.27	40,000.00	0.00

Similarly, we can compute depreciation of third year is equal to 40,000 - zero into 8 by 55 that comes out to be 8 into 727.2727 comes out to be Rupees 5818.18. So book value is, book value at the end of third year 26181.82 - 5818.18 which comes out to be Rupees 20,363.64. Similarly, depreciation of fourth year, 7 into 727.2727 comes out to be Rupees 5090.91 and

book value at the end of fourth year, Rupees 20363.64 - 5090.71 comes out to be Rupees 15272.73.

Now, similarly I can find out for fifth year, sixth year up to the seventh year. Deprecation of 10th year equal to 727.2727 into 1 comes out to be Rupees 727.2727. Now, this is the table which shows, the depreciation for the, up to the 10 th year, and we see that the total depreciation or the cumulative depreciation is 40,000 and the salvage value has decreased up to zero.

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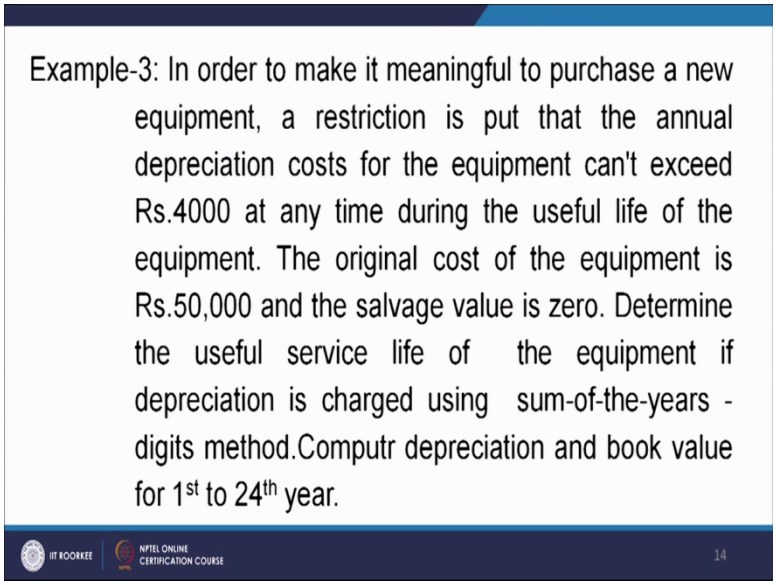

So, the sum-of-the-digits method can be applied for zero salvage value as well as salvage value which are positive. Now, let us see the example three. In order to make it meaningful to purchase a new equipment, a restriction is put that the annual depreciation costs for the equipment cannot exceed 4000 Rupees. That means the maximum depreciation which one can charge is 4000 Rupees at any time during the useful life of the equipment. The original cost of the equipment is Rupees 50,000 and the salvage value is zero. Determine the useful service life of the equipment if depreciation is charged using sum-of-the-years-digits method. Compute depreciation and book value for 1 to 24 years.

Now, this has got a trick. I had already told you that the maximum depreciation is in the first year, that means if I can charge maximum depreciation in any year of the service life, I can charge it in the first year. So, we can take that the first year depreciation in a sum-of-the–years-digit method will be 4000 in this case and if it take this then it is easier for us to calculate or the solve the problem.

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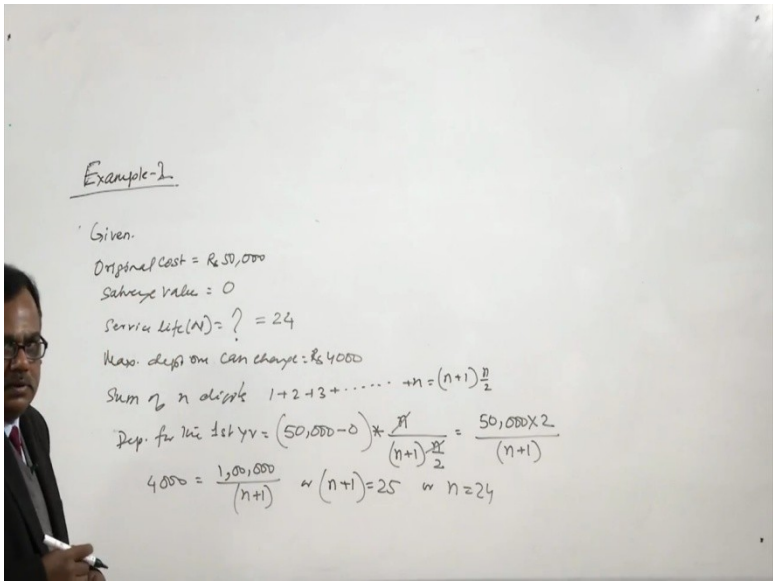

So, given is original cost is equal to Rupees 50,000, salvage value equal to zero, service life N is what I do not know? It has to be calculated and the maximum depreciation I can charge one can charge is Rupees 4000. These are the parameters I had already told that the maximum depreciation can be charged on the first year because the depreciation charged subsequently are lesser than the first year.

Now, we know that if I sum of n digits will be equal to if is 1, 2, 3….up to n digits if I sum it, this is equal to n + 1, n divided by 2. So, the depreciation for the first year will be 50,000 - zero, the salvage value into n divided by n + one n by 2 and you can cut these two n's. So, is equal to 50,000 into 2 divided by n + 1.

Now, this can be equated to 4000 that means 4000 is equal to 1,00,000 divided by n + 1 or n + one is equal to 25 or n is equal to 24. So, we have computed the value of n, this comes out to be 24. Now, the things are simple, we have to compute the depreciation from first year to 24th year and tabulate it. So, this will take a log of, lot of time that is why I have already calculated using excel and I will show that to you.

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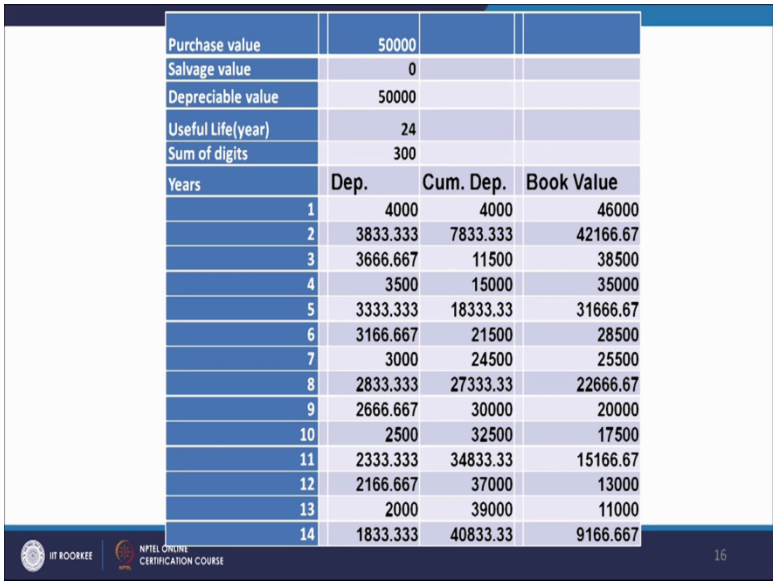
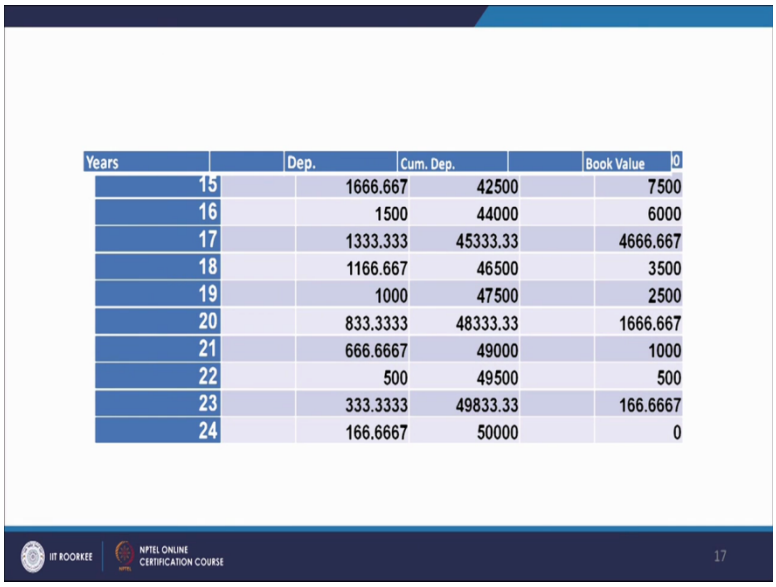


Purchase value	50000		
Salvage value	0		
Depreciable value	50000		
Useful Life(year)	24		
Sum of digits	300		
Years	Dep.	Cum. Dep.	Book Value
1	4000	4000	46000
2	3833.333	7833.333	42166.67
3	3666.667	11500	38500
4	3500	15000	35000
5	3333.333	18333.33	31666.67
6	3166.667	21500	28500
7	3000	24500	25500
8	2833.333	27333.33	22666.67
9	2666.667	30000	20000
10	2500	32500	17500
11	2333.333	34833.33	15166.67
12	2166.667	37000	13000
13	2000	39000	11000
14	1833.333	40833.33	9166.667



Years	Dep.	Cum. Dep.	Book Value
15	1666.667	42500	7500
16	1500	44000	6000
17	1333.333	45333.33	4666.667
18	1166.667	46500	3500
19	1000	47500	2500
20	833.3333	48333.33	1666.667
21	666.6667	49000	1000
22	500	49500	500
23	333.3333	49833.33	166.6667
24	166.6667	50000	0

Now, this is the table which shows depreciation up to 14 th year and here, we will see that in the first year the depreciation cost is 4000 and this was up to 24 th year and here, we see that the accumulation of the depreciation or the cumulative value of the depreciation is 50,000 and the book value at the end of the 24 th year is zero.

Now, let me summarize. The monetary value of an asset decreases over time due to use of wear and tear and obsolescence and this is obviously, this is the cause for charging deprecation and in this lecture, I have demonstrated how to use sum-of-the-digits method of depreciation and has, and have shown you that what are the benefits of the sum-of-the–year's-digit method vis-a-vis the declining-balance method and double–declining balance method. Thank you.