Depreciation, Alternate Investment and Profitability Analysis.
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Lecture-2.
Depreciation Straight Line and Repair Provision Method.

Welcome to the course depreciation, alternate investment and profitability analysis, I am Professor Bikash Mohanty department of chemical engineering, IIT Roorkee. In this lecture I will be covering some part of module 1 that is depreciation. The topic of this lecture is straight line and repair provision methods for computation of depreciation, alternate investment and profitability analysis. In this course, today's lecture, I will cover some part of the module 1 that is depreciation. In this module 1, I will cover straight line method for computing depreciation and repair provision method for computing depreciation.

The concept of depreciation is based on the fact that the physical facilities deteriorate and decline in usefulness with time, the example is very simple if you are using a machine, there will be wear and tear in the machine and its usefulness will decrease. The physical depreciation is a term given to the measure, the decrease in the value of a facility due to changes in the physical aspect of a property. Wear and tear, corrosion, accidents and detoriation due to age of the elements are all causes a physical depreciation.

With this type of depreciation, the serviceability of a property is reduced because of the physical changes. Depreciation due to all other causes is known as functional depreciation, that means due to wear and tear and physical damage of the elements of the equipment the depreciation not only takes place, it also talks place due to other causes and these causes are called functional depreciation. One common type of functional depreciation is obsolescence, for example earlier there were mechanical watches we were wearing, now with the introduction of electronic watches slowly the mechanical watches phased out due to obsolescence.

This is caused by technological advancements which make an existing property absolute. For example, suppose a piece of equipment that had been put into use for ten years ago at a total cost of rupees 31,000, the equipment is now worn out and is worth only 1,000 as scrap material. That means this salvage value or the scrap value of the equipment is only 1,000 after ten years of use. The decrease in value during the ten year period is thus equal to 31,000 - 1,000 which comes out to be rupees 30,000.

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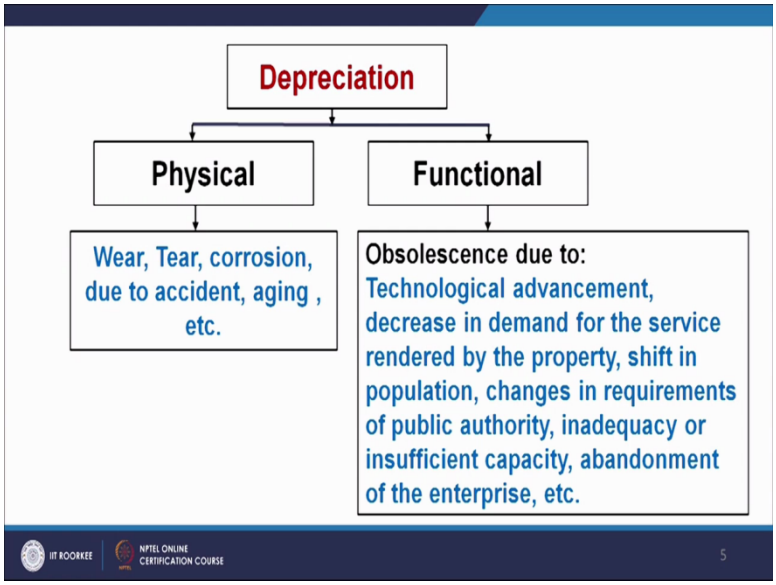

However, the engineer recognizes that this rupees 30,000 is in reality a cost incurred for the use of the equipment. Now depreciation can be divided into two types, the first type is called physical depreciation and the second type is called functional depreciation. The physical depreciation is due to wear and tear, corrosion, due to accident, due to aging, etc. But the functional depreciation is due to technological advancement decrease in demand for the service rendered by the property, shift in population, changes in requirements of public authority, inadequacy or insufficient capacity and abandonment of the enterprise, etc.

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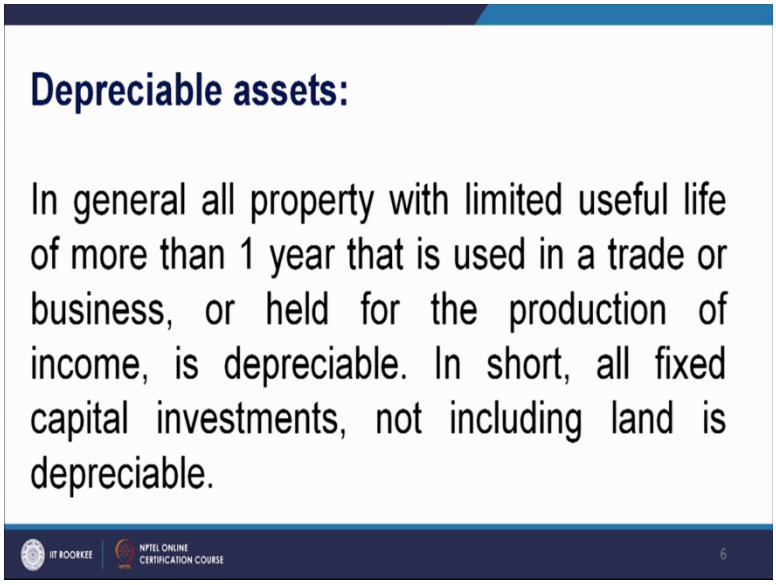

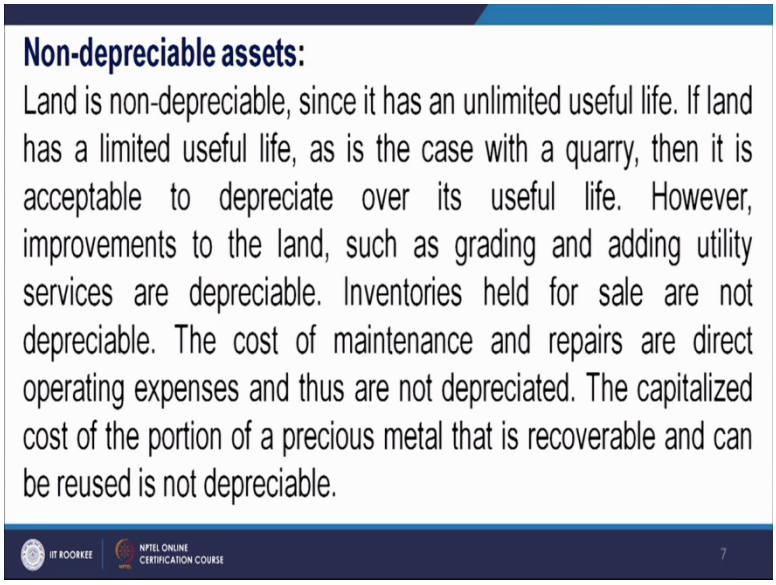

Now what are the depreciable assets? In general all property with limited useful life of more than one year that is used in a trade or business, or held for the production of income, is depreciable. In short, all fixed capital investments, not including land is depreciable. Then what are the non-depreciable assets? Land is non-depreciable, since it has an unlimited useful life. If land has a limited useful life, as is the case with a quarry, then it is acceptable to depreciate over its useful life.

However, improvements to the land, such a grading and adding utility services are depreciable. Inventories held for sale are not depreciable. The cost of maintenance and repairs are direct operating expenses and thus are not depreciated. The capitalized cost of the portion of a precious material that is recoverable and can be used is not depreciable. Now what is the purpose of charging depreciation? Following are the purpose of charging depreciation of fixed assets.

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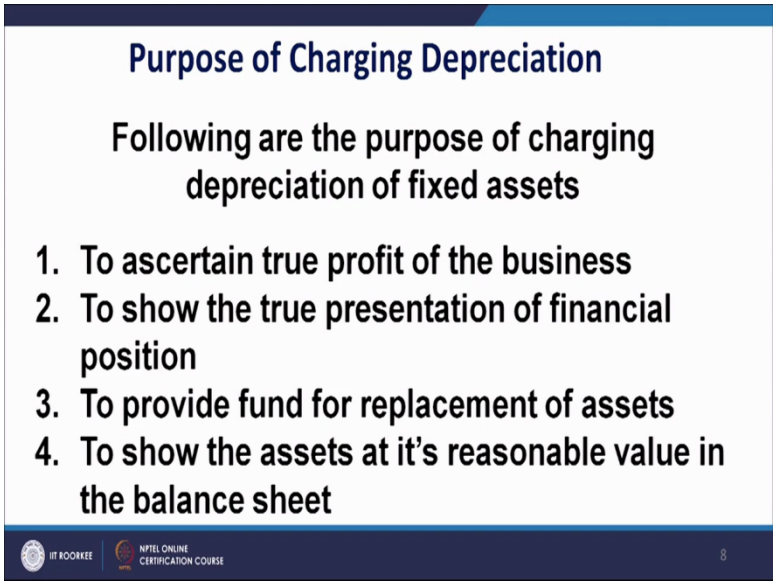

Number 1 to ascertain true profit of the business, now number 2 to show the true presentation of financial position, number 3 to provide fund for replacement of assets, number 4 to show the assets at its reasonable value in the balance sheet. Fact is affecting the amount of depreciation, that means what are the factors which are used for the calculation of amount of depreciation following factors are considered while charging amount of depreciation.

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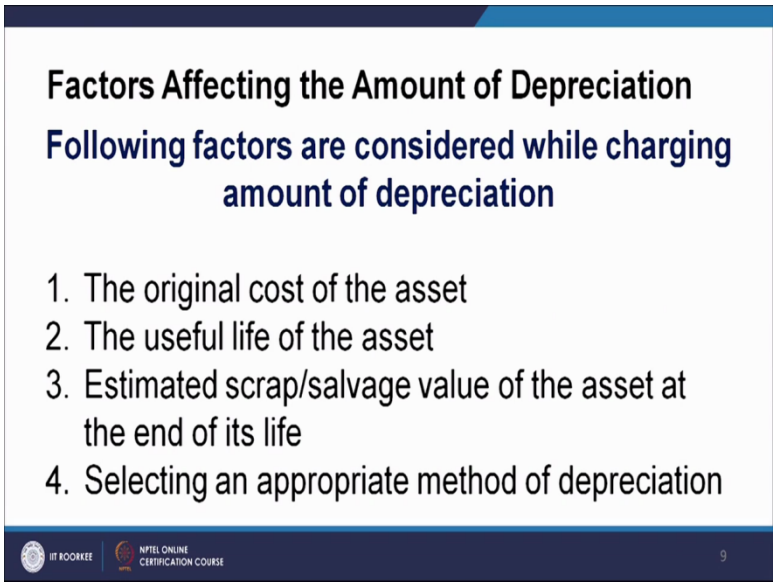

Number 1 is the original cost of the asset because during depreciation the depreciable amount is calculated as the initial cost of the asset - the salvage value of the asset. So the initial cost or the original cost of the assets finds a place in the calculation of depreciation.

The second is the useful life of the asset because the depreciation spreads the depreciable cost across the useful life of the asset, it spreads over the useful life of the asset and hence the useful life of the asset is another parameter. Estimated scrap or salvage value of the asset at the end of the life I have already talked about this because the depreciable amount is equal to the original cost of the asset - the salvage value and hence salvage value finds a place in a computation of amount of depreciation.

Then selecting an appropriate method of depreciation, this is also important because the depreciation affects the income tax or I should say the depreciation affects the profit and the profit affects the income tax and hence we can only use those depreciation methods which are recommended by government. Now let us see some definitions which are used in depreciation.

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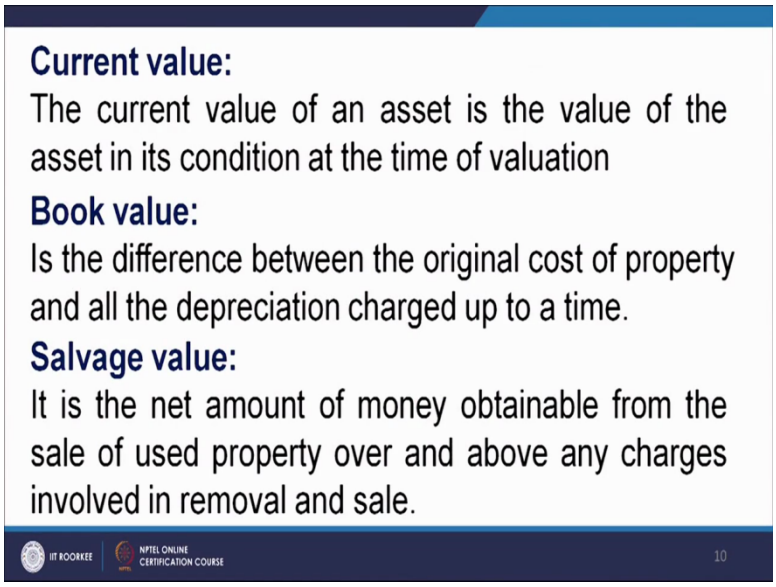

The current value of an asset, the current value of an asset is the value of the asset in its condition at the time of valuation. Book value, a lot of reference of this book value you will find out in our numericals and the computation of depreciation.

Now the book value is defined as it is the difference between original cost of property and all the depreciation charges up to a time. That means if I want to find out the book value at the start of the fifth year this will be equal to the original value of the equipment or the property - depreciation accumulative depreciation of all the previous four years, that will give me the book value. Now salvage value, it is a net amount of money obtainable from the sale of used property over and above any charges involved in removal and sale.

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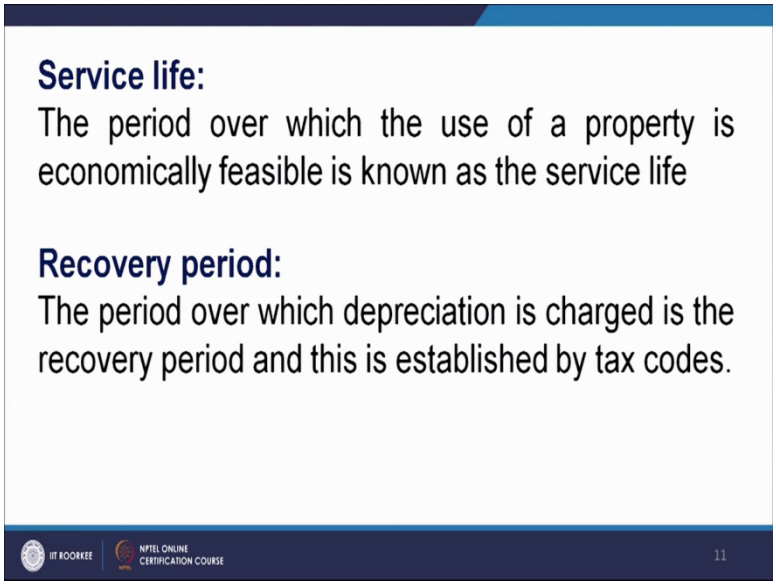

Now what is service life? The period over which the use of a property is economically feasible is known as the service life. Now why is it telling economically feasible, if the repair and maintenance cost are very high during a period then it is better to sell up that property and purchase a new rather than continuously investing money in repair and maintenance and this will only happen when the repair and maintaience charges are very high in comparison to the cost of the equipment.

Recovery period, the period over which depreciation is charged is the recovery period and this is established by tax codes. That means government mentions what is a recovery period for a equipment we will see later on that there are tables in which the recovery period or useful life of a equipment is specified by the government for the purpose of calculation of depreciation.

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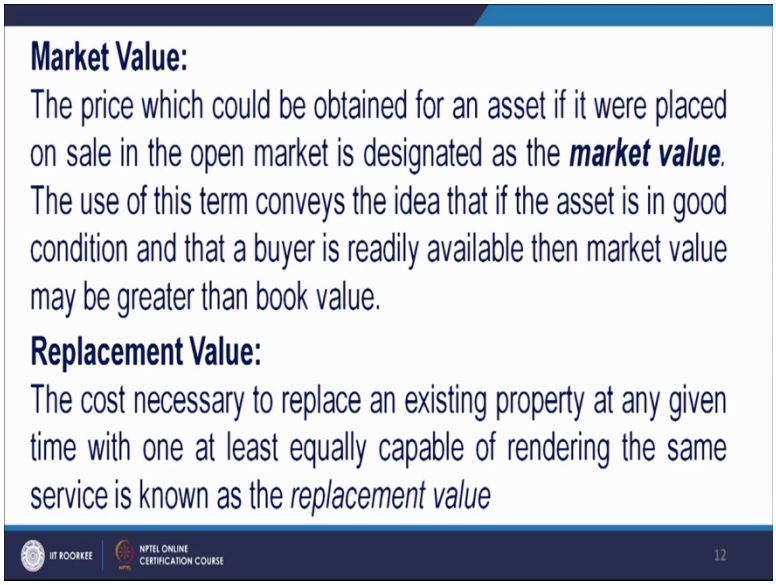

The market value, the price which could be obtained for an asset if it were placed on sale in the open market is designated as the market value. The use of this term conveys the idea that if the asset is in good condition and that a buyer is readily available then market value may be greater than the book value.

In the calculation of the book value, we assume a salvage value and this is an assumption. So if the equipment is maintained properly and it is in the better condition it may fetch a higher value than book value in the time of retirement of the property or retirement of the equipment. So market value may differ than the book value. Replacement value, the cost necessary to replace an existing property at any given time with one at least equally capable of rendering the same service is known as the replacement value.

The replacement value may not be equal to the original purchased value of the equipment because suppose ten years back you had purchased the equipment with rupees 10,000 and after ten years if you are purchasing the same equipment or at least a equipment which is equally capable that may not be 10,000 because the purchasing value of rupees decreases.

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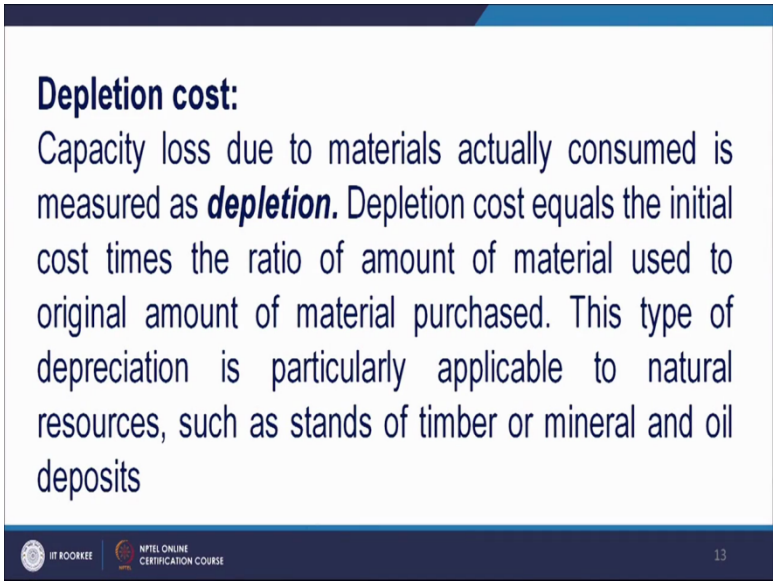

Now what is a depletion cost? Capacity lost due to material actually consumed is measured as depletion. Depletion cost equals the initial cost times the ratio of amount of material used to original amount of material purchased. This type of depreciation is particularly applicable to natural resources such as stands of timber or mineral and oil deposits.

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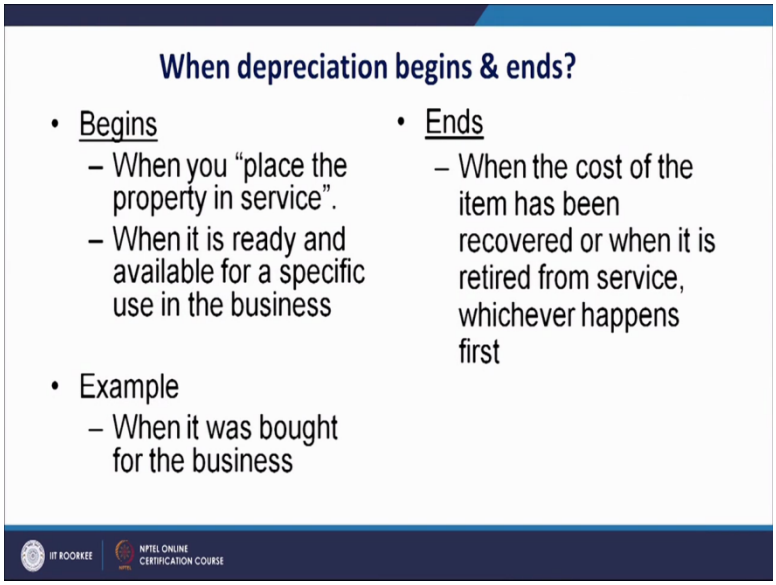

When depreciation begins and ends? They begins, when the depreciation will start, when you place the property in service, when it is ready and available for a specific use in the business, examples, when it was brought for the business. So when was brought for the business, then the depreciation will start will start computing depreciation on this. When it will end? When the cost of the item has been recovered or when it is retired from service, whichever happens

first, example, when it is sold or is no longer useable. Now the estimated service life of the equipment I had already told you that the depreciation affects the net profit of an industry and the industry gives the income tax based on its net profit.

So the computation of depreciation affects the income tax indirectly or directly. Thus, government controls the computation of income tax it indirectly controls the computation of depreciation as well. And hence the government gives tables for the useful life of an equipment because useful life of a equipment affects the computation of income tax.

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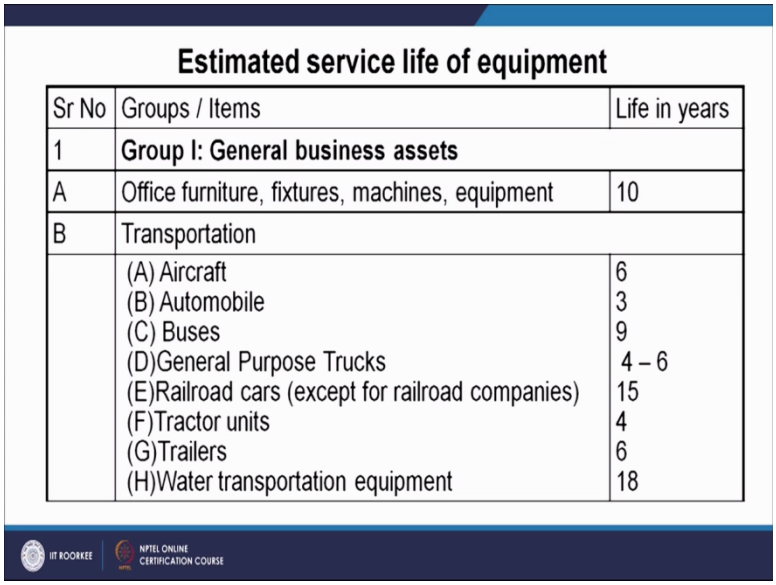

So a sample copy of a table is given how the government fixes the life of equipment for the computation of income tax. Now here it is written that in office furniture fixtures and machines and equipment the useful life taken is ten years.

For transportation, aircraft, the useful life is six years, automobiles, it is three years, buses, it is nine years, general purpose trucks, it is four to six years, railroad cars, except for railroad companies it is fifteen years, tractor units, it is four years, trailers, it is six years and water transportation equipment, it is around eighteen years.

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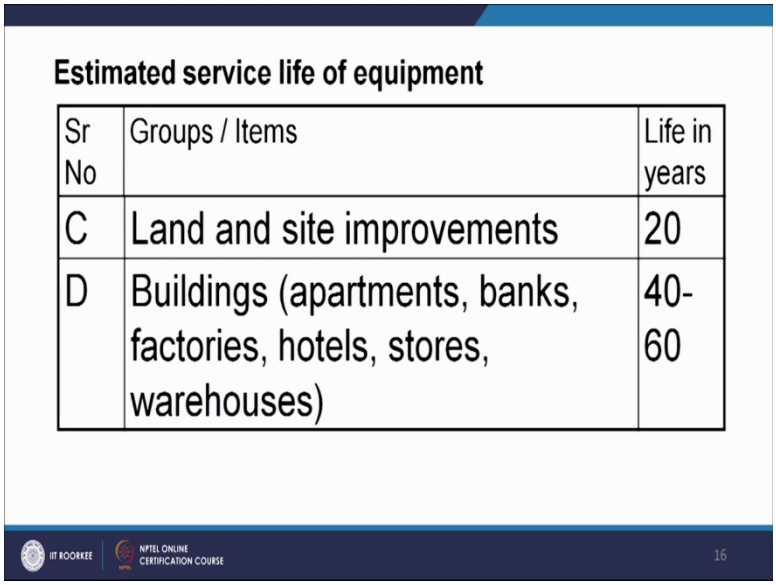

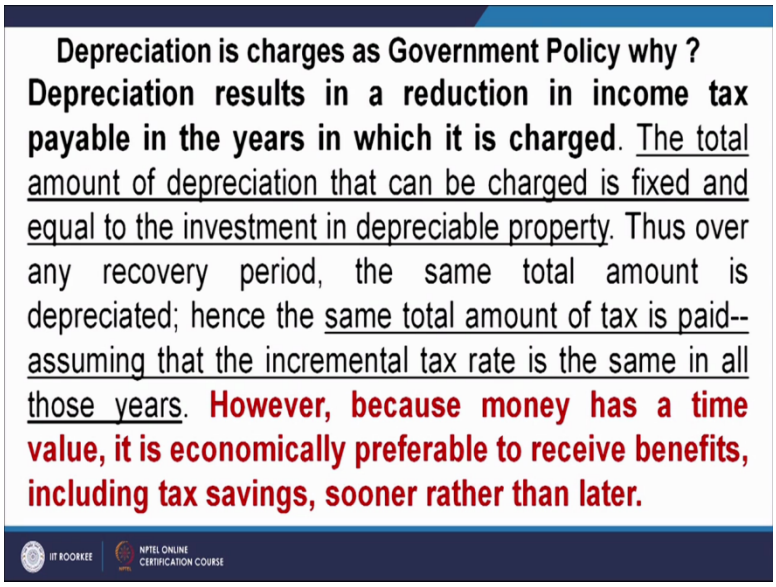

Similarly, the useful for land and site improvements is twenty years, buildings (apartments, banks, factories, hotels, stores, warehouses) useful life they vary between forty to sixty years. So for Indian government, Indian government will find similar tables in which the useful life of different equipment or different facilities are given. Now depreciation is charged by the government depreciation results in a reduction in income tax as I was explaining, payable in the years in which it is charged, the total amount of depreciation that can be charged is fixed and equal to the investment in depreciable properties because the original cost - salvage cost is the depreciable amount. So depreciable amount is fixed, but how I charge the depreciation throughout its life is not fixed.

That means I can more depreciation at the start and I can charge less depreciation at the end of the useful life of the equipment or I can charge less depreciation at the start or beginning of the equipment and more at the end. So this flexibility is with me, but this flexibility will affect the income tax and thus government tells us how to charge the depreciation. Thus over any recovery period the same total amount is depreciated, hence the same total amount of tax is paid assuming that the incremental tax rate is the same in all those years.

What what is the meaning of this incremental tax rate? Because if you see the taxes and policy of India, taxes is dependent on the slabs, different slabs has got different tax. But here we assume that incremental tax rate is the same in all these years, that means tax rate does not vary within a large range of the depreciable amount. However, because money has a time value it is economically preferable to receive benefits, including tax savings, sooner than the later. This I had in detail covered in my earlier lecture series which were on time value of money.

Therefore, it is usually in the taxpayer's interest to depreciate property as rapidly as possible. From the federal government's perspective, however, for the same reason it is preferable to receive revenue sooner than after. So counter balancing this from the government point of view is the desire to encourage business activity and thus the overall economy. For these reasons the rate and length of time during which depreciation can be charged are a matter of government policy. So we conclude that the charging of depreciation is not totally in our hands, it should be based on government policy.

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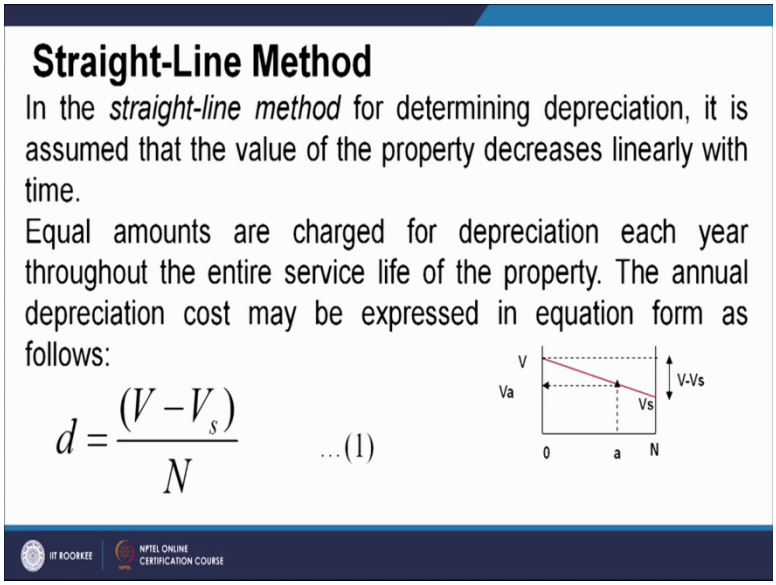

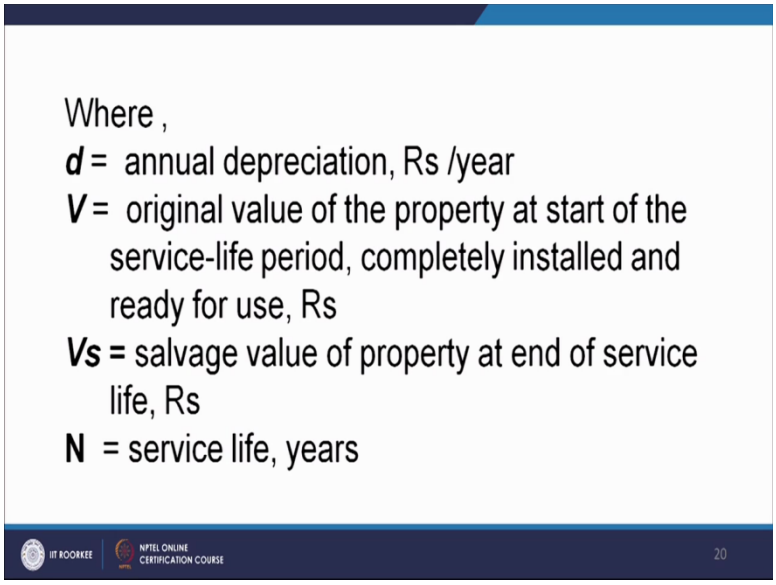

Now there are different depreciation computation methods the simplest method is the straight line method. In the straight line method for determining depreciation, it is assumed that the value of the property decreases linearly with time, that means equal amounts are charged for depreciation each year throughout the entire service life of the property. The annual depreciation cost may be expressed in equation form as follows. So the equation is d that is depreciation is equal to V - Vs divided by N and the right hand side figure I have shown that depreciation amount that means the amount which has to be depreciated is from V to Vs.

That is the gap between V and Vs and this has to depreciated in N years and if I am taking a straight line method so I join V to Vs with a straight line, where d is equal to annual depreciation rupees per year, the unit is. V is equal to original value of the property at the start of the service life period, completely installed and ready for use, Vs is equal to salvage value of the property at the end of the service life, it is in rupees and N is the service life in years. The asset value or the book value of the equipment at any time during this surface life may be determined from the following equation.

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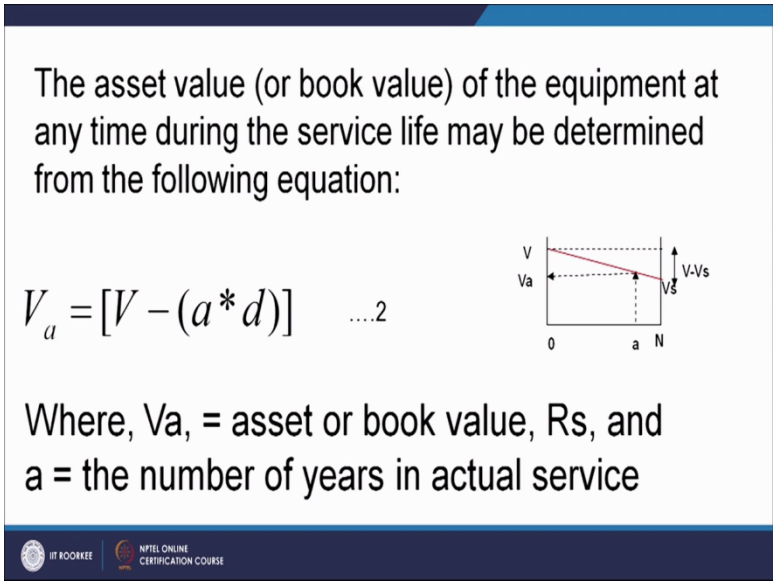

Va, that means the book value in the year a is equal to V - a into d, where a is the year and d is the depreciation rate, where is Va is equal to asset or book value in rupees and a is the number of years in actual service. Because of its simplicity the straight line method is widely used for determining depreciation cost, in general design engineers report economic evaluations on the basis of straight line depreciation unless there is some specific reason for using one of the other methods.

Because it is impossible to estimate exact service lives and salvage values when a property is first put into use it is sometimes desirable to re-estimate these factors from time to time during the life period of the property. Now as we can estimate depreciation by a straight line method, we can also estimate depreciation using multiple straight line methods.

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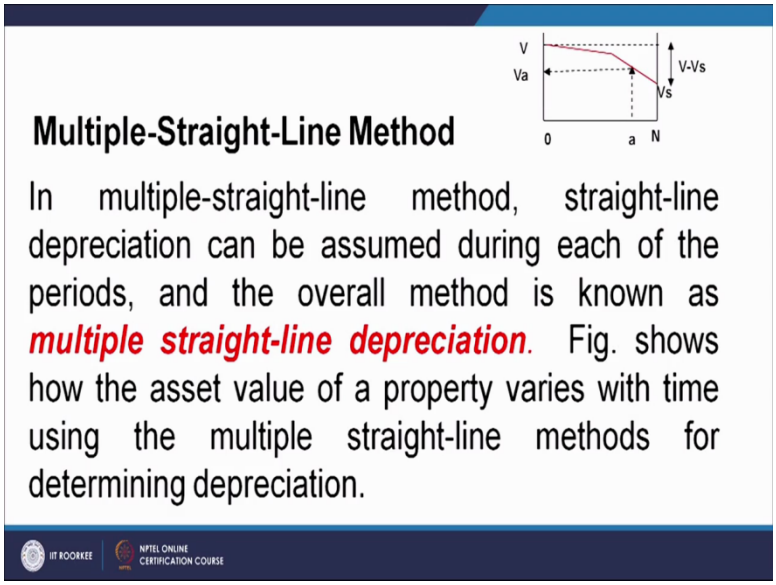

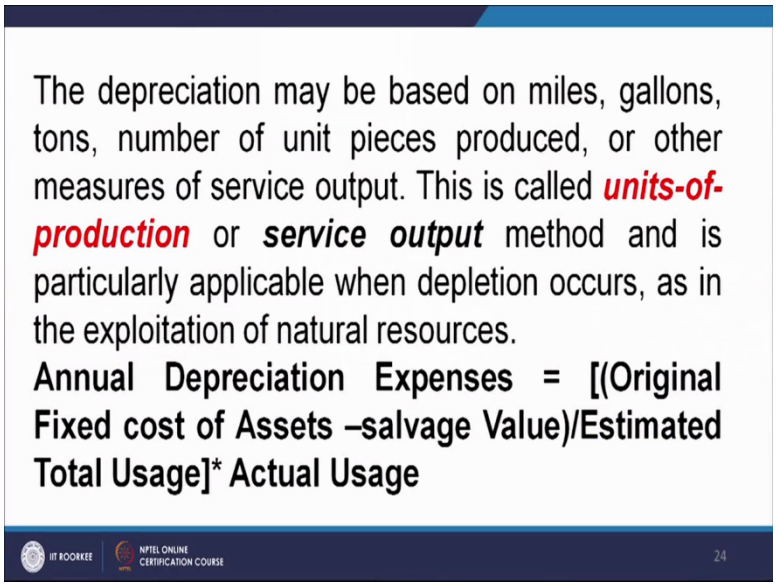

In multiple straight line method, straight line depreciation can be assumed during each of the period, and the overall method is known as multiple straight-line depreciation. The figure above shows how the asset value of the property varies with time using the multiple straight-line method for determining depreciation.

The depreciation may be based on miles, gallons, tons, number of unit pieces produced or other measures of service output. When this is done, this is called units of production or service output method and is particularly applicable when depletion occurs, as in the exploitation of natural resources. If I am using this method, then my annual depreciation expense is equal to original fix cost of the asset - salvage value divided by estimated total usage into actual usage.

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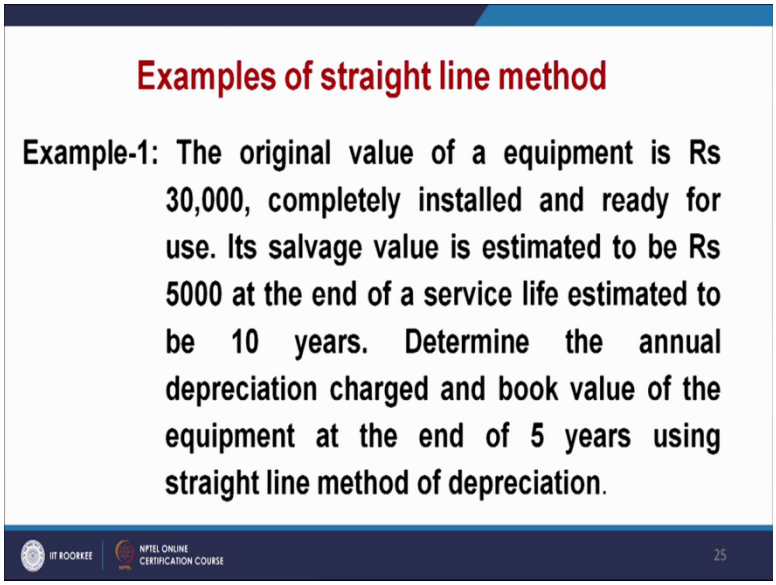

Let us take some examples of straight line method, the example number one the original value of a equipment is rupees 30,000, completely installed and ready for use. Its salvage value is estimated to be rupees 5,000 at the end of a service life estimated to be 10 years. Determine the annual depreciation charged and book value of the equipment at the end of 5 years using straight line method of depreciation.

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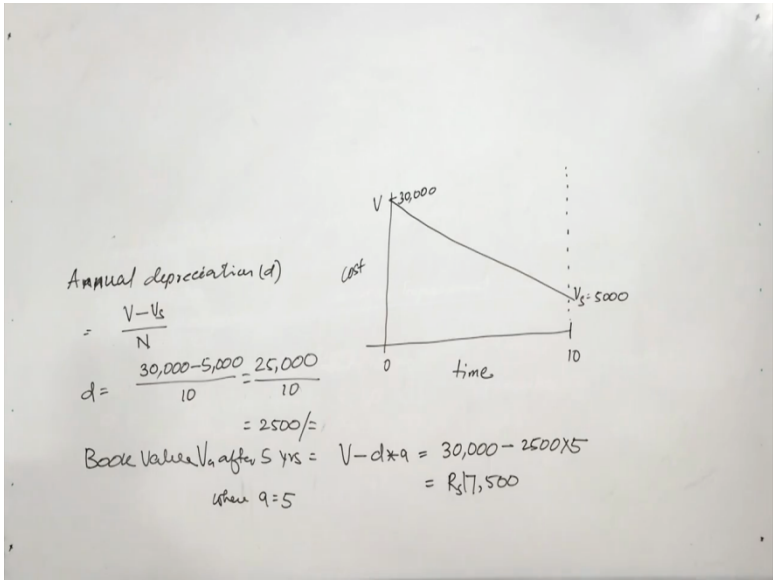

So let us solve this, given V equal to 30,000, Vs equal to 5,000, N is equal to 10 and we have to calculate d and book value V5. No if you plot this, this is cost, this is time, this is zero, this is 10 and this is V 30,000 it decreases to Vs is equal to 5,000 and the time taken for this decrease is 10 years, so we formalize annual depreciation d is equal to V - Vs divided by N,

so d is equal to 30,000 - 5,000 divided by 10 so is equal to 25,000 divided by 10 is equal to 2,500. So my depreciation is 2,500 now I have to calculate the book value Va after 5 years is equal to V - V into a is equal to 30,000 - 2,500 into 5, this comes out to be rupees 1,7500, where a is equal to 5.

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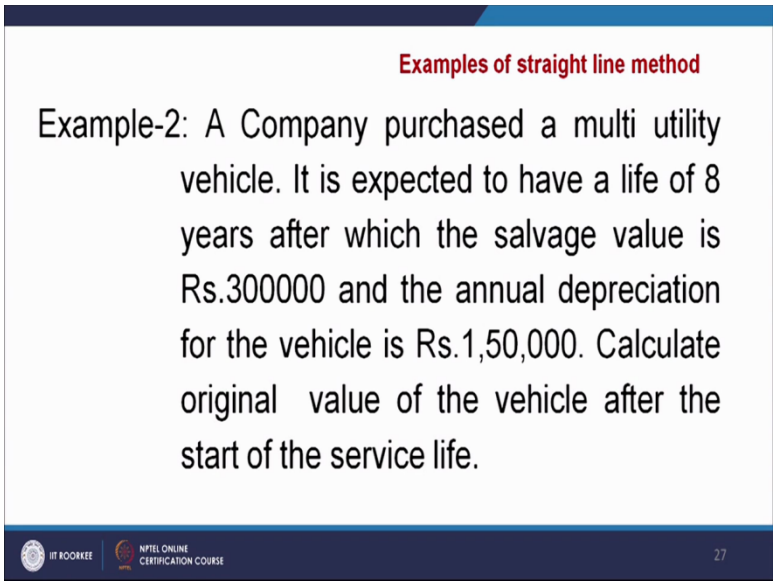

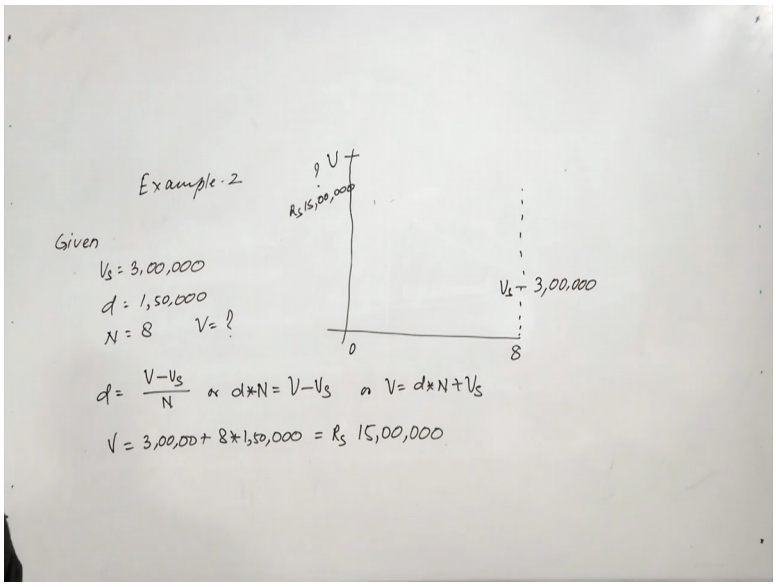

Now this is the solution of this example, now let us take the example another example of this straight line method, example number 2. A company purchased a multi utility vehicle. It is expected to have a life of 8 years after which the salvage value is 300000 and the annual depreciation for the vehicle is 1,50,000. Calculate the original value of the vehicle after the start of the service life. So example 2, this is 8 years this is this is 300000 Vs, this is V so what is the value, this is zero.

So given are Vs equal to 300000, d is equal to 1,50,000, N equal to 8 and V is equal to what? This is the question. Now we know that d is equal to V - Vs divided by N or d into N is equal to V - Vs or V is equal to d into N + Vs, so when you put these values, V is equal to 300000 + d equal to 8 years into 1,50,000, it comes out to be rupees 15,00,000. So my the value of V comes out to be rupees 15,00,000. So this is the second problem of the straight line method.

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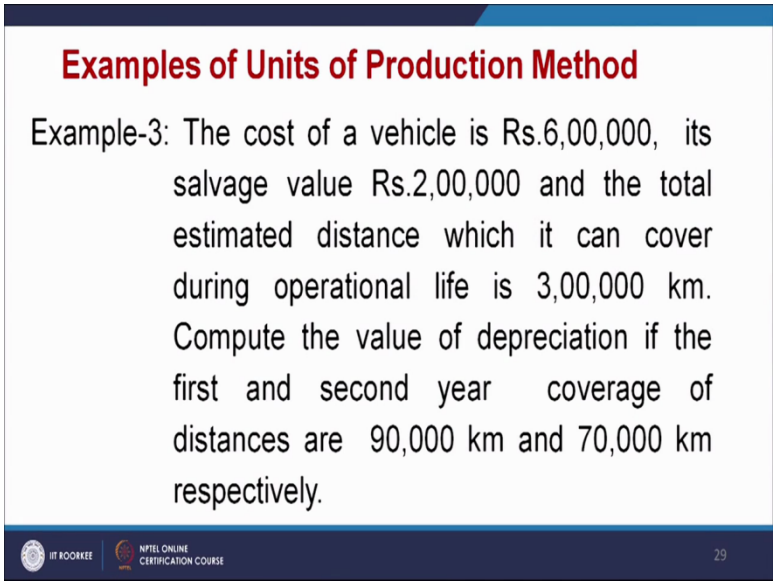

Now there is a third example and this example is based on units of production method. The cost of a vehicle is 6,00,000, its salvage value is 2,00,000 and the total estimated distance which it can cover during the operational life is 3,00,000 km. Now in this problem you see that the useful life is not given but in place of the useful life the useful kilometers that this vehicle could travel is given. So the N is replaced by the useful kilometers the vehicle can travel and which is 3,00,000 kilometer. Compute the value of depreciation if the first and second year coverage of distances are 90,000 kilometer and 70,000 kilometers respectively.

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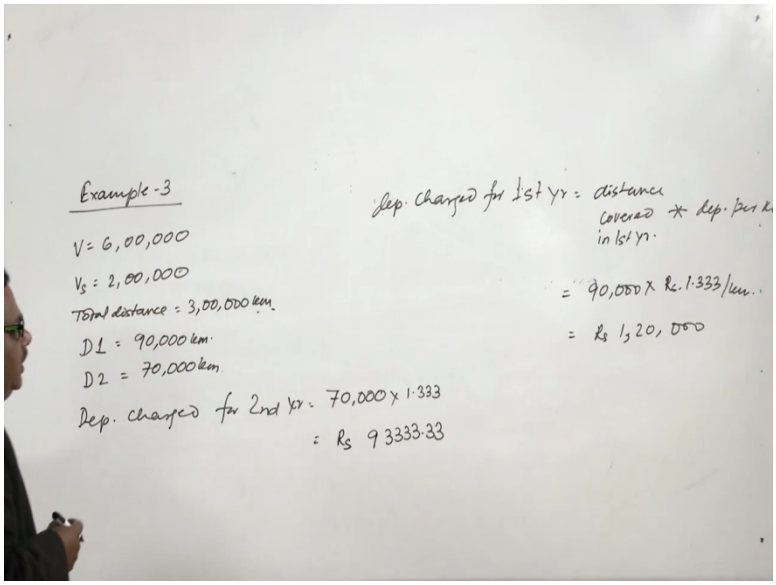

So what are given to us is example 3, V is given 6,00,000, Vs is given 2,00,000 and total distance which can be covered by the vehicle is equal to 3,00,000 kilometer, now distance travel in the first year if I call it d1 then this is 90,000 kilometer and the distance traveled in the year 2 if I call it d2 this is 70,000 kilometer. So depreciation per kilometer is equal to V - Vs divided by the total distance the vehicle can travel is 3,00,000 kilometers, this comes out to be 6,00,000 - 2,00,000 divided by 3,00,000 is comes out to be rupees 1.333 per kilometer.

So we see here the depreciation the unit of depreciation is rupees per kilometer. So depreciation charged for first year, first year is equal to distance covered in first year into depreciation per kilometer, this comes out to be 90,000 into rupees 1.333 per kilometer, so this comes out to be rupees 1,20,000. Now similarly, I can calculate out the depreciation charged for second year is equal to 70,000 this d2 70,000 into 1.333, which comes out to be rupees 9. So the depreciation charge for the first year is 1,20,000 rupees and the depreciation charge for the second year is 70,000 rupees.

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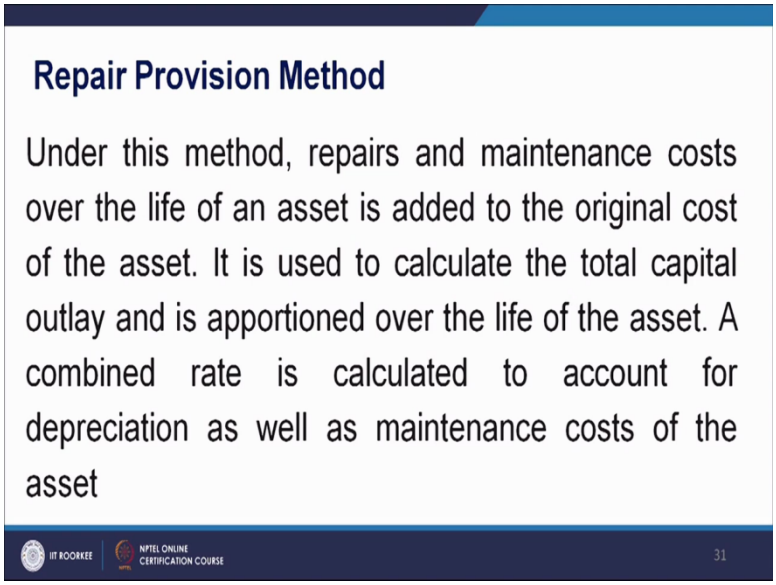

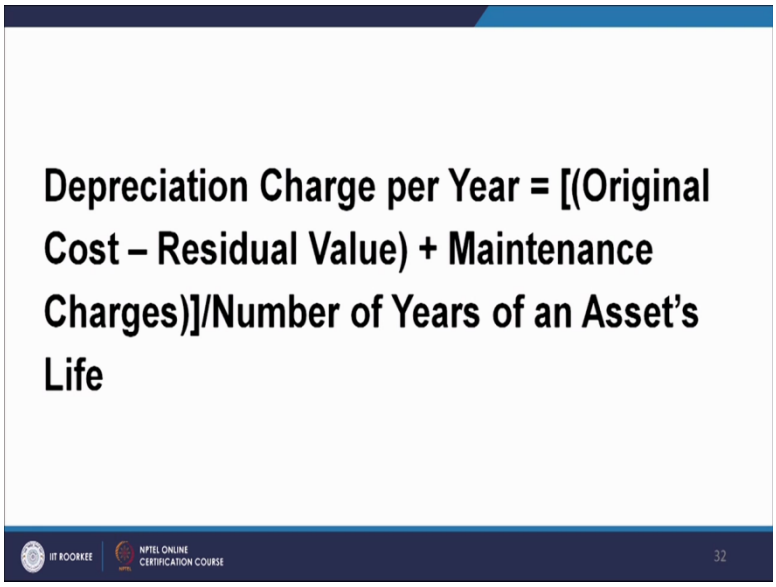

Now the another method which is close to the straight line method is repair provision method. Under this method, repairs and maintenance costs over the life of an asset is added to the original cost of the asset. It is used to calculate the total capital outlay and is apportioned over the life of the asset. A combined rate is calculated to account for depreciation as well as maintenance costs of the asset. The formula is depreciation charged per year is original cost - the residual cost + maintenance cost divided by the number of years of an asset.

The repair provision method is applied in conjunction with other methods of calculating depreciation such as straight line, declining balance etc. Fluctuations of cost due to abnormal and use maintenance in a particular period can be avoided by using this method, since cost of maintenance is evenly spread throughout the life of the asset. The drawback of this method is

that it is almost impossible to accurately forecast the maintenance cost of an asset. The amount of repairing expenses during life of an asset is estimated and then the annual amount is calculated.

The annual amount is charged to the product cost each year and kept in the repair provision account. Actual repair expenses incurred in the life time of the asset is charged to the repair provision account. The balance amount at the end of the life of the asset is transferred to the profit and loss account. Now let us take an example on repair provision method.

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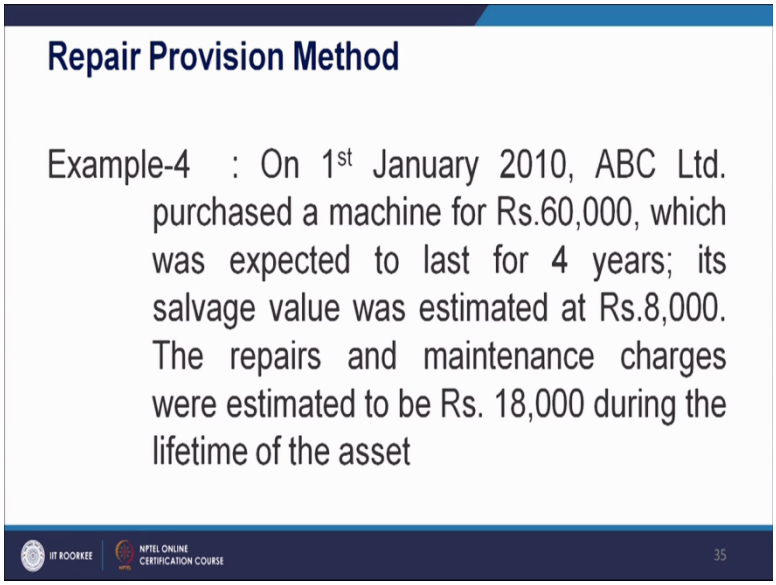

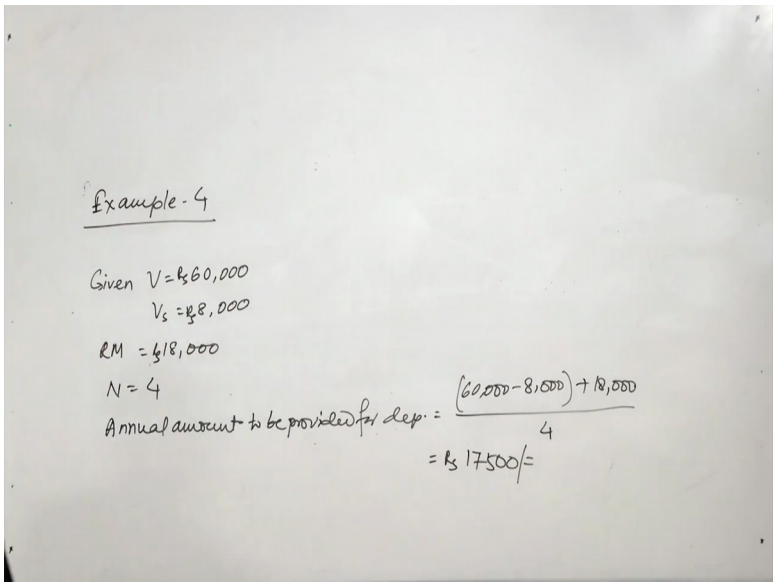

Example number 4. On first January 2010, ABC limited purchased a machine for rupees 60,000, which was expected to last for 4 years; its salvage value was estimated to be 8,000. The repair and maintenance charges were estimated to be 18,000 during the life of the asset.

Now what the given is, V is 60,000, Vs is 8,000, repair and maintenance if I call RM, repair and maintenance is equal to 18,000, N is equal to 4.

Now the d annual amount to be provided for depreciation is equal to 60,000 - 8,000 + 18,000 divided by 4 this comes out to be rupees 17,500. So this is the solution of the example number 4. Summary, the monetary value of an asset decreases over time due to the use wear and tear and obsolescence. This decrease is measured as depreciation and can be used as a means of distributing the original cost of a physical asset over the life period during which the asset is in use employing many methods.

The present lecture demonstrated how to use straight line and repair provision method for computation of depreciation, thank you.