	Next year's maintenance cost	years, used to decide replacement.

Basic Formulae Used:

- **Total Cost:** $TC = C + \Sigma M - S$
- **Average Cost per Year:** $AC = \frac{TC}{n} = \frac{C+\Sigma M-S}{n}$
- **Replacement Rule:** Replace the asset when next year's maintenance cost exceeds current average cost

CLASS 18

Replacement of items whose maintenance cost increases with time and the value of money remain same during the time period:

Replacement of items whose maintenance cost increases with time and the value of money remains the same during the time period refers to the process of deciding the optimal time to replace an asset, like machinery or equipment, whose repair and upkeep costs rise as it ages, while assuming that the value of money does not change over time (no inflation or discounting). The objective is to minimize the average total cost per year, which includes purchase cost, increasing maintenance costs, and scrap value, so that the asset is neither replaced too early-wasting its useful life-nor too late-incurring excessive maintenance expenses.

Benefits of Timely Replacement of Equipment with Rising Maintenance Costs:

- Lower Total Operating Cost: When maintenance costs continuously increase over time, replacing the item at the right stage reduces the overall expenditure.

- Elimination of Escalating Repair Expenses: Frequent repairs and part replacements are avoided, preventing unnecessary spending on aging equipment.

- Improved Reliability: New equipment performs more consistently and reduces the risk of unexpected failures.

- Better Resource Utilization: Time, labor, and effort spent on maintaining old equipment can be redirected toward more productive activities.

• Economic Decision-Making Simplicity: Since the value of money remains constant over the period, comparison between maintenance cost and replacement cost becomes easier and more accurate.

Limitations of Replacing Equipment with Increasing Maintenance Costs (When Money Value Remains Constant):

- **High Initial Capital Requirement**: Replacement requires a large lump-sum investment, which may strain financial resources.
- **Possible Under-utilization of Existing Asset**: The old equipment may still have usable life left, leading to premature disposal and loss of remaining value.
- **Installation and Transition Costs**: Additional costs such as installation, training, and setup may increase total replacement expense.
- **Uncertainty of New Equipment Performance**: The new item may not perform exactly as expected, leading to operational risks.
- **Disruption During Replacement**: Production or operations may be temporarily interrupted during the replacement process.

CLASS 19

Question 5:

A company purchases a machine for 10,000 Rs. The expected maintenance costs and scrap values for each year are given below:

Year	Maintenance Cost (Rs)	Scrap Value (Rs)
1	1000	8000
2	1500	6500
3	2200	4000
4	3200	2000
5	4500	0

Determine the optimal year to replace the machine to minimize the average cost per year, assuming the value of money remains the same.

Solution 5:

Given that a company purchases a machine for 10,000 Rs. Also, the expected maintenance costs and scrap values for each year are given as:

Year	Maintenance Cost (Rs)	