Q The Cost of new machine is Rs 5000. The maintenance cost of nth year is given $C_n = 500(n-1)$; $n = 1, 2, \ldots$ Suppose that the discount rate per year is 0.05. After how many years it will be economical to replace the machine by a new one

Sol

$$v = (1+0.05)^{-1} = 0.9523$$

$1 - 1.05$

$1 - \frac{1}{1.05}$

Present worth of the money to be spent over a period of one year

year (n)	R_{n-1}	v^{n-1}	$R_{n-1} v^{n-1}$	$C + \sum_{k=1} R_{k-1} v^{k-1}$	$\sum v^{k-1}$	$W(n)$
1	Rs 0	v^0 1.0000	0	5000,	1.000	5000
2	Rs 500	v^1 0.9523	476	5476	1.9523	2805
3	Rs 1000	v^2 0.9070	907	6383	2.8593	2232
4	Rs 1500	v^3 0.8638	1296	7679	3.7231	2063
5	Rs 2000	v^4 0.8227	1645	9324	4.5458	2051
6	Rs 2500	0.7835	1959	11283	5.3293	2117

$$R_{n-1} < \frac{C + R_0 + vR_1 + v^2R_2 + v^3R_3 + \cdots + v^{n-1}R_{n-1}}{1 + v + v^2 + \cdots + v^{n-1}} < R_n$$

$W(n)$ weight average cost of all the previous n years

$$R_4 < W(5) < R_6$$

$$1500 < 2051 < 2500$$

It is economical to replace the machine by a new one at the end of 5th year

PROBLEMS

1820. Let $v = 0.9$ and initial price is Rs. 5,000. Running cost varies as follows :

Year	:	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Running cost (in Rs.)	:	400	500	700	1,000	1,300	1,700	2,100

What would be the optimum replacement interval?

1821. The initial cost of an item is Rs. 15,000 and maintenance or running costs for different years are given below :

Year	:	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Running cost (in Rs.)	:	2,500	3,000	4,000	5,000	6,500	8,000	10,000

What is the replacement policy to be adopted if the capital is worth 10% and there is no salvage value?

1822. The yearly cost of 2 machines *A* and *B* when the money value is neglected is as follows :

Year	:	*1*	*2*	*3*	*4*	*5*
Machine *A*	:	1,800	1,200	1,400	1,600	1,000
Machine *B*	:	2,800	200	1,400	1,100	600

Find their cost patterns if money value is 10% per year and hence find which machine is most economical. ***[Madras B.E. (Mech.) 1999]***

1823. A manual stamper currently valued at Rs. 1,000 is expected to last 2 years and costs Rs. 4,000 per year to operate. An automatic stamper which can be purchased for Rs. 3,000 will last 4 years and can be operated at an annual cost of Rs. 3,000. If money carries the rate of interest 10% per annum, determine which stamper should be purchased.

1824. A manufacturer is offered two machines *A* and *B*. *A* is priced at Rs. 5,000 and running costs are estimated at Rs. 800 for each of the first five years, increasing by Rs. 200 per year in the sixth and subsequent years. Machine *B*, which has the same capacity as *A*, costs Rs. 2,500 but will have running costs of Rs. 1,200 per year for six years, increasing by Rs. 200 per year thereafter.

If money is worth 10% per year, which machine should be purchased? (Assume that the machines will eventually be sold for scrap at a negligible price.) ***[Madras B.E. 1999]***

1825. An engineering company is offered two types of material handling equipment *A* and *B*. *A* is priced at Rs. 60,000 including cost of installation, and the costs for operation and maintenance are estimated to be Rs. 10,000 for each of the first five years, increasing by Rs. 3,000 per year in the sixth and subsequent year. Equipment *B* with a rated capacity same as *A*, requires an initial investment of Rs. 30,000 but in terms of operation and maintenance costs more than *A*. These costs for *B* are estimated to be Rs. 13,000 per year for the first six years, increasing by Rs. 4,000 per year for each year from the 7th year onwards. The company expects a return of 10 per cent on all its investments. Neglecting the scrap value of the equipment at the end of its economic life, determine which equipment the company should buy. ***[Indore M.B.A. 1989]***

1826. An individual is planning to purchase a car. A new car will cost Rs. 1,20,000. The resale value of the car at the end of the year is 85% of the previous year value. Maintenance and operation costs during the first year are Rs. 20,000 and they increase by 15% every year. The minimum resale value of car can be Rs. 40,000.

(*i*) When should the car be replaced to minimise average annual cost (ignore interest)?

(*ii*) If interest of 12% is assumed, when should the car be replaced? ***[Kerala M.Com. 1990]***