Worst Case:

$$= ₹\ 1,00,000 + \frac{₹\ 20,000}{(1+0.20)^1} + \frac{₹\ 20,000}{(1+0.20)^2} + \frac{₹\ 20,000}{(1+0.20)^3} + \frac{₹\ 20,000}{(1+0.20)^4} + \frac{₹\ 20,000}{(1+0.20)^5}$$

= - ₹ 1,00,000 + ₹ 16,666.67 + ₹ 13,888.89 + ₹ 11,574.07 + ₹ 9,645.06 + ₹ 8037.76

NPV = - ₹ 40,187.76

Base Case:

$$= -₹\ 1,00,000 + \frac{₹\ 30,000}{(1+0.20)^1} + \frac{₹\ 30,000}{(1+0.20)^2} + \frac{₹\ 30,000}{(1+0.20)^3} + \frac{₹\ 30,000}{(1+0.20)^4} + \frac{₹\ 30,000}{(1+0.20)^5} + \frac{₹\ 20,000}{(1+0.20)^5}$$

NPV = -₹ 2,244.08

Best Case:

$$= ₹\ 1,00,000 + \frac{₹\ 40,000}{(1+0.20)^1} + \frac{₹\ 40,000}{(1+0.20)^2} + \frac{₹\ 40,000}{(1+0.20)^3} + \frac{₹\ 40,000}{(1+0.20)^4} + \frac{₹\ 40,000}{(1+0.20)^5} + \frac{₹\ 30,000}{(1+0.20)^5}$$

= - ₹ 1,00,000 + ₹ 33,333.33 + ₹ 27,777.78 + ₹ 23,148.15 + ₹ 19,290.12 + ₹ 16,075.10 + ₹ 12,056.33

NPV = ₹ 31,680.81

Expected NPV

= (- ₹ 40,187.76 × 0.1) + (-₹ 2,244.08 × 0.7) + (₹ 31,680.81 × 0.2)

= ₹ 746.52

(ii) For the worst case, the cash flows from the cash flow column farthest on the left are used to calculate NPV

$$= ₹\ 1,00,000 + \frac{₹\ 20,000}{(1+0.20)^1} + \frac{₹\ 20,000}{(1+0.20)^2} + \frac{₹\ 20,000}{(1+0.20)^3} + \frac{₹\ 20,000}{(1+0.20)^4} + \frac{₹\ 20,000}{(1+0.20)^5}$$

= - ₹ 1,00,000 + ₹ 16,666.67 + ₹ 13,888.89 + ₹ 11,574.07 + ₹ 9,645.06 + ₹ 8037.76

NPV = - ₹ 40,187.76

For the best case, the cash flows from the cash flow column farthest on the right are used to calculated NPV

$$= ₹\ 1,00,000 + \frac{₹\ 40,000}{(1+0.20)^1} + \frac{₹\ 40,000}{(1+0.20)^2} + \frac{₹\ 40,000}{(1+0.20)^3} + \frac{₹\ 40,000}{(1+0.20)^4} + \frac{₹\ 40,000}{(1+0.20)^5} + \frac{₹\ 30,000}{(1+0.20)^5}$$

= - ₹ 1,00,000 + ₹ 33,333.33 + ₹ 27,777.78 + ₹ 23,148.15 + ₹ 19,290.12 + ₹ 16,075.10 + ₹ 12,056.33

NPV = ₹31,680.81

(iii) If the cash flows are perfectly dependent, then the low cash flow in the first year will mean a low cash flow in every year. Thus, the possibility of the worst case occurring is the probability of getting ₹20,000 net cash flow in year 1 is 10%.

Question: 22

Following are the estimates of the net cash flows and probability of a new project of M/s X Ltd.:

	Year	P = 0.3	P = 0.5	P = 0.2
Initial investment	0	4,00,000	4,00,000	4,00,000
Estimated net after tax cash inflows per year	1 to 5	1,00,000	1,10,000	1,20,000
Estimated salvage value (after tax)	5	20,000	50,000	60,000

Required rate of return from the project is 10%. Find:

(i) The expected NPV of the project.

(ii) The best case and the worst case NPVs.

(iii) The probability of occurrence of the worst case if the cash flows are perfectly dependent overtime and independent overtime.

(iv) Standard deviation and coefficient of variation assuming that there are only three streams of cash flow, which are represented by each column of the table with the given probabilities.

(v) Coefficient of variation of X Ltd. on its average project which is in the range of 0.95 to1.0. If the coefficient of variation of the project is found to be less risky than average, 100basis points are deducted from the Company's cost of Capital

Should the project be accepted by X Ltd?

(SM TYK – 07)

Solution:

(i) Expected NPV

Worst Case

ENPV = (-)4,00,000 + 1,00,000 × 3.790 + 20,000 × 0.621

= -₹ 8,580/-

Base Case

ENPV = (-)4,00,000 + 1,20,000 × 3.790 + 60,000 × 0.621

= ₹ 92,060/-.

Best Case

ENPV = (-)4,00,000 + 1,20,000 × 3.790 + 60,000 × 0.621

= ₹ 92,060/-.

Expected NPV

= 0.30 × (-) 8,580 + 0.5 × 47,950 + 92,060 × 0.20

= ₹ 39,813/-

(ii) ENPV of The Worst Case

1,00,000 × 3.790 = ₹ 3,79,000

(Students may have 3.791 also the values will change accordingly)

20,000 × 0.621 = ₹ 12,420/-

ENPV = (-)4,00,000 + 3,79,000 + 12,420 = (-) ₹ 8,580/-

ENPV of the best case

ENPV = (-)4,00,000 + 1,20,000 × 3.790 + 60,000 × 0.621

= ₹ 92,060/-.

(iii) (a) Required probability = 0.3

(b) Required probability = $(0.3)^5$ = 0.00243

(iv) The base case NPV = (-) 4,00,000 + (1,10,000 × 3.79) + (50,000 × 0.621)

= ₹ 47,950/-

ENPV = 0.30 × (-) 8,580 + 0.5 × 47,950 + 92,060 × 0.20

= ₹ 39,813/-

Therefore,

$$\sigma_{ENPV} = \sqrt{0.3(-8,580-39,813)^2 + 0.5(47,950-39,813)^2 + 0.2 + (92,060-39,813)^2}$$

= ₹ 35,800/-

Therefore, CV = 35,800/39,813

= 0.90

(v) Risk adjusted out of cost of capital of X Ltd. = 10% - 1% = 9%.

NPV

Expected Cash Flows

1 to 5 = (1,00,000 × 0.3 +1,10,000 × 0.5 + 1,20,000 × 0.2)

= 1,09,000

Expected Salvage Value [5th year]

= (20,000 × 0.3 + 50,000 × 0.5 + 60,000 × 0.2)

= 43,000

NPV = (1,09,000 × 3.890) + (43,000 × 0.650) – 4,00,000

= ₹ 51,960

Therefore, the project should be accepted.

Question – 23

Cyber Company is considering two mutually exclusive projects. Investment outlay of both the projects is ₹ 5,00,000 and each is expected to have a life of 5 years. Under three possible situations their annual cash flows and probabilities are as under:

		Cash Flow (₹)	
Situation	Probabilities	Project A	Project B
Good	0.3	6,00,000	5,00,000
Normal	0.4	4,00,000	4,00,000
Worse	0.3	2,00,000	3,00,000

The cost of capital is 7 per cent, which project should be accepted? Explain with workings.

(SM TYK – 02)

Solution:

Expected Cash Flows & Standard Deviation

Project A

Expected Cash Flows

= (6,00,000 × 0.3) + (4,00,000 × 0.4) + (2,00,000 × 0.3)

= 4,00,000

$$\sigma_x = \sqrt{(6,00,000 - 4,00,000)^2 \ 0.3 \ + \ (4,00,000 - 4,00,000)^2 + (2,00,000 - 4,00,000)^2 \ 0.3}$$

= ₹ 1,54,919

Project B

ENCF = 0.3 (5,00,000) + 0.4 (4,00,000) + 0.3 (3,00,000)

= 4,00,000

σ^2 = 0.3 (5,00,000 – 4,00,000)^2 + 0.4 (4,00,000 – 4,00,000)^2 + 0.3 (3,00,000 – 4,00,000)^2

σ = $\sqrt{6,00,00,00,000}$

σ = 77,459.66

Expected NPV

A = (4,00,000 × PVAF 7 % 5) – 5,00,000

= (4,00,000 × 4.100) – 5,00,000 = 11,40,000

B = (4,00,000 × 4.100) – 5,00,000 = 11,40,000

Project B should be accepted due to lower risk.

Recommendation: NPV in both projects being the same, the project should be decided on the basis of standard deviation and hence project 'B' should be accepted having lower standard deviation, means less risky.

(iii) Simulation

Question – 24

Cost of Machine = ₹ 1,30,000

Discounting Rate = 10% p.a.

Annual Cash Flow		Project Life	
Value (₹)	Probability	Value (Year)	Probability
10,000	0.02	3	0.05
15,000	0.03	4	0.10
20,000	0.15	5	0.30
25,000	0.15	6	0.25
30,000	0.30	7	0.15
35,000	0.20	8	0.10
40,000	0.15	9	0.03

		10	0.02

Random Number

53479	81115	98036	12217	59526
97344	70328	58116	91964	26240
66023	38277	74523	71118	84892
99776	75723	03172	43112	83086
30176	48979	92153	38416	42436
81874	83339	14988	99937	13213
19839	90630	71863	95053	55532
09337	33435	53869	52769	18801
31151	58295	40823	41330	21093
67619	52515	03037	81699	17106

Take beginning two digit random number. One for annual cash flows & second for project life.

Solution:

Annual Cash Flow				Project Life			
Value (₹)	Probabil-ity	Cumula-tive Probabil-ity	Tow Digit Random No.	Value (Year)	Probabil-ity	Cumula-tive Probabil-ity	Two Digit Random No.
10,000	0.02	0.02	00 – 01	3	0.05	0.05	00 – 04
15,000	0.03	0.05	02 – 04	4	0.10	0.15	05 – 14
20,000	0.15	0.20	05 – 19	5	0.30	0.45	15 – 44
25,000	0.15	0.35	20 – 34	6	0.25	0.70	45 – 69
30,000	0.30	0.65	35 – 64	7	0.15	0.85	70 – 84
35,000	0.20	0.85	65 – 84	8	0.10	0.95	85 – 94
40,000	0.15	1.00	85 - 99	9	0.03	0.98	95 – 97
				10	0.02	1.00	98 - 99

Simulation Results

Annual Cash Flow			Project Life			
Run	Random No.	Corres. Value of Annual Cash Flow (1)	Random No.	Corres. Value of Project Life	PVAF @ 10% (2)	NPV (1) × (2) – 1,30,000
1	53	30,000	97	9	5.759	42,770
2	66	35,000	99	10	6.145	85,075
3	30	25,000	81	7	4.868	(8,300)

4	19	20,000	09	4	3.170	(66,600)
5	31	25,000	67	6	4.355	(21,125)
6	81	35,000	70	7	4.868	40,380
7	38	30,000	75	7	4.868	16,040
8	48	30,000	83	7	4.868	16,040
9	90	40,000	33	5	3.791	21,640
10	58	30,000	52	6	4.355	650

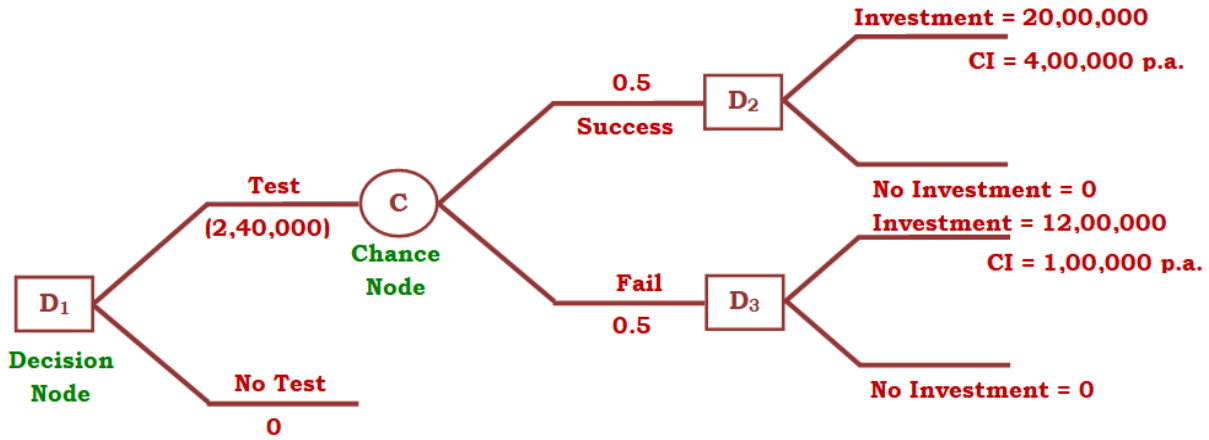
(iv) Decision Tree

Question – 25

L & R Limited wishes to develop new virus-cleaner software. The cost of the pilot project would be ₹ 2,40,000. Presently, the chances of the product being successfully launched on a commercial scale are rated at 50%. In case it does succeed. L&R can invest a sum of ₹20 lacs to market the product. Such an effort can generate perpetually, an annual net after tax cash income of ₹4 lacs. Even if the commercial launch fails, they can make an investment of a smaller amount of ₹12 lacs with the hope of gaining perpetually a sum of ₹1 lac. Evaluate the proposal, adopting decision tree approach. The discount rate is 10%.

Solution:

Decision tree diagram is given below:



DECISION TREE

At Decision Point D_2

Option 1: If investment NPV $= \frac{4,00,000}{10\%} - 20,00,000 = 20,00,000$

Option 2: No investment NPV = 0

No investment is better

At Decision Point D_3

Option 1: Investment NPV = $\frac{1,00,000}{10\%}$ – 12,00,000 = -2,00,000

Option 2: No investment NPV = 0

Investment is better due to higher NPV

Calculation of EMV at Point C

EMV = (20,00,000 × 0.5) + (0 × 0.5)

= 10,00,000

At Decision Point D_1

Option 1: Testing NPV = (10,00,000 – 2,40,000) = ₹ 7,60,000

Option 2: No Testing NPV = 0

Testing is better due to higher NPV

PART 3: REPLACEMENT DECISION

Question – 26

Company X is forced to choose between two machines A and B. The two machines are designed differently but have identical capacity and do exactly the same job. Machine A costs ₹ 1,50,000 and will last for 3 years. It costs ₹ 40,000 per year to run. Machine B is an 'economy' model costing only ₹ 1,00,000, but will last only for 2 years, and costs ₹ 60,000 per year to run. These are real cash flows. The costs are forecasted in rupees of constant purchasing power. Ignore tax. Opportunity cost of capital is 10 per cent. Which machine company X should buy?

(SM TYK – 24)

Solution:

Calculation of EAPVCO

Machine A

PVCO = 1,50,000 + (40,000 × 2.487)

= 2,94,474

EA PVCO $= \frac{\text{PVCO}}{\text{PVAF}} = \frac{2,49,480}{2.487} = 1,00,314$

Machine B

PVCO = 1,00,000 + (60,000 × 1.735)

EA PVCO $= \frac{2,04,100}{1.735} = 1,17,637$

Question – 27

A Company named Roby's cube decided to replace the existing Computer system of their organization. Original cost of old system was ₹ 25,000 and it was installed 5 years ago. Current market value of old system is ₹ 5,000. Depreciation of the old system was charged with life of 10 years with Estimated Salvage value as Nil. Depreciation of the new system will be charged with life over 5 years Present cost of the new system is ₹ 50,000. Estimated Salvage value of the new system is ₹1,000. Estimated cost savings with new system is ₹ 5,000 per year. Increase in sales with new system is assumed at 10% per year based on original total sales of ₹ 1,00,000. Company follows straight line method of depreciation. Cost of capital of the company is 10% whereas tax rate is 30%.

Solution:

Calculation of NPV

		Year	PVF (10%)	Amount	P.V.
(A)	Cash outflows				
	Cost of new machine	0	1,000	50,000	50,000
	Sale of old machine (W.N.1)	0	1,000	(7,250)	(7,250)
					42,750
(B)	Cash inflows				
	Incremental CFAT (W.N.2)	1-5	3.791	12,690	48,108
	Incremental T.V. [2,000 – 0]	5	0.621	1,000	621
	(B)				48,729

NPV (B – A)				5,979

Since NPV is positive, hence old machine should be replaced.

W.N. 1: Sale of Old Machine

Sales consideration	= ₹ 5,000	.....(i)
(-) B.V.	= ₹ 12,500	
Capital loss	= ₹ 7,500	
Tax saving @ 30%	= 2,250	.....(ii)
Net (i + ii)	= 7,250	

W.N. 2: Incremental CFAT

Increase in sales [₹ 1,00,000 × 10%]	= ₹ 10,000	
Saving in Exp	= ₹ 5,000	
Incremental CFAT	= ₹ 15,000	.....(i)
(-) Incremental depreciation		
[Depreciation of new – Depreciation of old]		
$\left[\left(\frac{50,000-1,000}{5}\right)-\frac{25,000}{10}\right]$	= ₹ 7,300	
PBT	= ₹ 7,700	
Tax @ 30%	= ₹ 2310	.....(ii)
Incremental CFAT (i + ii)	= 12,690	

Question – 28

A company has an old machine having book value zero – which can be sold for ₹ 50,000. The company is thinking to choose one from following two alternatives:

(i) To incur additional cost of ₹ 10,00,000 to upgrade the old existing machine.

(ii) To replace old machine with a new machine costing ₹ 20,00,000 plus installation cost ₹ 50,000.

Both above proposals envisage useful life to be five years with salvage value to be nil.

The expected after tax profits for the above three alternatives are as under :

Year	Old existing Machine (₹)	Upgraded Machine (₹)	New Machine (₹)
1	5,00,000	5,50,000	6,00,000
2	5,40,000	5,90,000	6,40,000
3	5,80,000	6,10,000	6,90,000
4	6,20,000	6,50,000	7,40,000
5	6,60,000	7,00,000	8,00,000

The tax rate is 40 per cent.

The company follows straight line method of depreciation. Assume cost of capital to be 15 per cent.

P.V.F. of 15%, 5 = 0.870, 0.756, 0.658, 0.572 and 0.497. You are required to advise the company as to which alternative is to be adopted.

(SM TYK – 23)

Solution:

Option 1: Upgraded Machine

Calculation of NPV

	1	2	3	4	5
Upgrade					
PAT	5,50,000	5,90,000	6,10,000	6,50,000	7,00,000
(+) Depreciation	2,00,000	2,00,000	2,00,000	2,00,000	2,00,000
CFAT	7,50,000	7,90,000	8,10,000	8,50,000	9,00,000
(-) CFAT (old)	5,00,000	5,40,000	5,80,000	6,20,000	6,60,000
Incremental CFAT	2,50,000	2,50,000	2,30,000	2,30,000	2,40,000
(×) PVF	0.870	0.756	0.658	0.572	0.497

PVCI = 8,08,680

(-) PVCO = 10,00,000

NPV = (1,91,320)

Option 2: New Machine

	1	2	3	4	5
New Machine					
PAT	6,00,000	6,40,000	6,90,000	7,40,000	8,00,000
(+) Depreciation $\frac{20,50,000}{5}$	4,10,000	4,10,000	4,10,000	4,10,000	4,10,000
CFAT	10,10,000	10,50,000	11,00,000	11,50,000	12,10,000
(-) CFAT (old)	5,00,000	5,40,000	5,80,000	6,20,000	6,60,000
Incremental CFAT	5,10,000	5,10,000	5,20,000	5,30,000	5,50,000
(×) PVF	0.870	0.756	0.658	0.572	0.497

Working Note 1:

Sale of old machine

Sale consideration	= 50,000
(-) B.V.	= 0
Capital gain	= 50,000
Tax @ 40%	= 20,000
	= 30,000
PVCI	= 17,47,930
(-) PVCO	= 20,20,000 [20,50,000 – 30,000]
NPV	= (2,72,070)

Since NPV is negative in both option, hence old machine without up gradation is better

Question – 29

A machine used on a production line must be replaced at least every four years. Costs incurred to run the machine according to its age are:

Age of the Machine (years)					
	0	1	2	3	4
Purchase price (in ₹)	60,000				
Maintenance (in ₹)		16,000	18,000	20,000	20,000
Repair (in ₹)		0	4,000	8,000	16,000
Scrap Value (in ₹)		32,000	24,000	16,000	8,000

Future replacement will be with identical machine with same cost. Revenue is unaffected by the age of the machine. Ignoring inflation and tax, determine the optimum replacement cycle. PV factors of the cost of capital of 15% for the respective four years are 0.8696, 0.7561, 0.6575 and 0.5718.

(SM TYK – 26)

Solution:

Working Notes

First of all, we shall calculate cash flows for each replacement cycle as follows:

One year replacement cycle ₹

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net Cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	32,000	16,000

Two years replacement cycle ₹

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net Cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	-	(16,000)
2	-	(22,000)	24,000	2,000

Three years replacement cycle ₹

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net Cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	-	(16,000)
2	-	(22,000)	-	(22,000)
3	-	(28,000)	16,000	(12,000)

Four years replacement cycle ₹

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net Cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	-	(16,000)
2	-	(22,000)	-	(22,000)
3	-	(28,000)	-	(28,000)
4	-	(36,000)	8,000	(28,000)

Now we shall calculate NPV for each replacement cycles

		1 Year		2 Years		3 Years		4 Years	
Year	PVF @ 15%	Cash Flows	PV	Cash Flows	PV	Cash Flows	PV	Cash Flows	PV
0	1	-60,000	-60,000	-60,000	-60,000	-60,000	-60,000	-60,000	-60,000
1	0.8696	16,000	13,914	-16,000	-13,914	-16,000	-13,914	-16,000	-13,914
2	0.7561	-	-	2,000	1,512	-22,000	-16,634	-22,000	-16,634
3	0.6575	-	-	-	0	-12,000	-7,890	-28,000	-18,410
4	0.5718	-	-	-	0		0	-28,000	-16,010
			-46,086		-72,402		-98,438		-1,24,968

Replacement Cycle		EAC (₹)
1 Year	$\frac{46,086}{0.8696}$	52,997
2 Years	$\frac{72,402}{1.6257}$	44,536
3 Years	$\frac{98,438}{2.2832}$	43,114
4 Years	$\frac{1,24,968}{2.855}$	43,772

Since EAC is least in case of replacement cycle of 3 years hence machine should be replaced after every three years.

Note: Alternatively, Answer can also be computed by excluding initial outflow as there will be no change in final decision.

Question – 30

Company Y is operating an elderly machine that is expected to produce a net cash inflow of ₹ 40,000 in the coming year and ₹ 40,000 next year. Current salvage value is ₹ 80,000 and next year's value is ₹ 70,000. The machine can be replaced now with a new machine, which costs ₹ 1,50,000, but is much more efficient and will provide a cash inflow of ₹ 80,000 a year for 3 years.

Company Y wants to know whether it should replace the equipment now or wait a year with the clear understanding that the new machine is the best of the available alternatives and that it in turn be replaced at the optimal point. Ignore tax. Take opportunity cost of capital as 10 per cent. Advise with reasons.

(SM TYK – 25)

Solution:

Calculation of NPV

	Year	PVF (10%)	Replace New		Replace on year	
			Amount	P.V.	Amount	P.V.
Cash outflows						
Cost of new machine	0	1.000	1,50,000	1,50,000	-	-
	1	0.909	-	-	1,50,000	1,36,350
Sale of old machine	0	1.000	(80,000)	(80,000)	-	-
	1	0.909	-	-	(70,000)	(63,630)
Total (A)				**70,000**		**72,720**
Cash inflows						
CFAT	1-3	2.487	80,000	1,98,960	-	-
	1	0.909	-	-	40,000	36,360
	2-4	2.261	-	-	80,000	1,80,880
Total (B)				**1,98,960**		**2,17,240**
NPV (B-A)				1,28,960		1,44,520

Machine should be replaced in year 1 due higher NPV.

Question – 31

X Ltd. is a taxi operator. Each taxi cost to company ₹ 4,00,000 and has a useful life of 3 years. The taxi's operating cost for each of 3 years and salvage value at the end of year is as follows:

	Year 1	Year 2	Year 3
Operating Cost	₹ 1,80,000	₹ 2,10,000	₹ 2,38,000
Resale Value	₹ 2,80,000	₹ 2,30,000	₹ 1,68,000

You are required to determine the optimal replacement period of taxi if cost of capital of X Ltd. is 10%.

Solution:

NPV if taxi is kept for 1 Year

= – ₹ 4,00,000 + ₹ 1,00,000 (0.909)

= – ₹ 3,09,100

NPV if taxi is kept for 2 Year

= – ₹ 4,00,000 – ₹ 1,80,000 × 0.909 + ₹ 20,000 × 0.826

= – ₹ 5,47,100

NPV if taxi is kept for 3 Year

= – ₹ 4,00,000 – ₹ 1,80,000 × 0.909 – ₹ 2,10,000 × 0.826 – ₹ 70,000 × 0.751

= – ₹ 7,89,650

Since above NPV figures relate to different periods, there are not comparable. to make them comparable we shall use concept of EAC as follows:

EAC of 1 year

$$\frac{3,09,100}{0.909} = ₹\ 3,40,044$$

EAC of 2 year

$$\frac{5,47,100}{1,735} = ₹\ 3,15,331$$

EAC of 3 year

$$\frac{7,89,650}{2,486} = ₹\ 3,17,639$$

Since lowest EAC incur if taxi for 2 year; Hence the optimum replacement cycle to replace taxi in 2 years.

Question – 32

Trouble Free Solutions (TFS) is an authorized service center of a reputed domestic air conditioner manufacturing company. All complaints/service related matters of Air conditioner are attended by this service center. The service center employs a large number of mechanics, each of whom is provided with a motor bike to attend the complaints. Each mechanic travels approximately 40,000 kms per annum. TFS decides to continue its present policy of always buying a new bike for its mechanics but wonders whether the

present policy of replacing the bike every three year is optimal or not. It is of believe that as new models are entering into market on yearly basis, it wishes to consider whether a replacement of either one year or two years would be better option than present three year period. The fleet of bike is due for replacement shortly in near future.

The purchase price of latest model bike is ₹ 55,000. Resale value of used bike at current prices in market is as follows:

Period	**₹**
1 Year old	35,000
2 Year old	21,000
3 Year old	9,000

Running and Maintenance expenses (excluding depreciation) are as follows:

Year	Road Taxes Insurance etc. (₹)	Petrol Repair Maintenance etc. (₹)
1	3,000	30,000
2	3,000	35,000
3	3,000	43,000

Using opportunity cost of capital as 10% you are required to determine optimal replacement period of bike.

(SM TYK – 27)

Solution:

NPV if Bike is kept for 1 Year

= – ₹ 55,000 + ₹ 2,000 (0.909)

= – ₹ 53,182

NPV if Bike is kept for 2 Year

= – ₹ 55,000 – ₹ 33,000 × 0.909 – ₹ 17,000 × 0.826

= – ₹ 99,039

NPV if Bike is kept for 3 Year

= – ₹ 55,000 – ₹ 33,000 × 0.909 – ₹ 38,000 × 0.826 – ₹ 37,000 × 0.751

= – ₹ 1,44,172

EAC of 1 year

$\frac{53,182}{0.909}$ = ₹ 58,506

EAC of 2 year

$\frac{99,039}{1,735}$ = ₹ 57,083

EAC of 3 year

$\frac{1,44,172}{2,486}$ = ₹ 57,993

Thus, from above table it is clear that EAC is least in case of 2 years, hence bike should be replaced every two years.

Question – 33

A & Co. is contemplating whether to replace an existing machine or to spend money on overhauling it. A & Co. currently pays no taxes. The replacement machine costs ₹ 90,000 now and requires maintenance of ₹ 10,000 at the end of every year for eight years. At the end of eight years it would have a salvage value of ₹ 20,000 and would be sold. The existing machine requires increasing amounts of maintenance each year and its salvage value falls each year as follows:

Year	Maintenance (₹)	Salvage (₹)
Present	0	40,000
1	10,000	25,000
2	20,000	15,000
3	30,000	10,000
4	40,000	0

The opportunity cost of capital for A & Co. is 15%.

Required:

When should the company replace the machine?

(Notes: Present value of an annuity of Re. 1 per period for 8 years at interest rate of 15% : 4.4873; present value of Re. 1 to be received after 8 years at interest rate of 15% : 0.3269).

(SM TYK – 22)

Solution:

A & Co.

Equivalent cost of (EAC) of new machine

		₹
(i)	Cost of new machine now	90,000
	Add: PV of annual repairs @ ₹ 10,000 per annum for 8 years (₹ 10,000 × 4.4873)	44,873
		1,34,873
	Less: PV of salvage value at the end of 8 years (₹ 20,000 × 0.3269)	6,538
		1,28,335
	Equivalent annual cost (EAC) (₹ 1,28,355/4.4873)	28,600

PV of cost of replacing the old machine in each of 4 years with new machine

Scenario	Year	Cash Flow	PV @ 15%	PV
		₹		₹
Replace Immediately	0	(28,600)	1.00	(28,600)
		40,000	1.00	40,000
				11,400
Replace in one year	1	(28,600)	0.870	(24,882)
	1	(10,000)	0.870	(8,700)
	1	25,000	0.870	21,750
				(11,832)
Replace in two years	1	(10,000)	0.870	(8,700)
	2	(28,600)	0.756	(21,622)
	2	(20,000)	0.756	(15,120)
	2	15,000	0.756	11,340
				(34,102)
Replace in three years	1	(10,000)	0.870	(8,700)
	2	(20,000)	0.756	(15,120)
	3	(28,600)	0.658	(18,819)
	3	(30,000)	0.658	(19,740)