Questions	INVESTMENT DECISIONS	Questions	INVESTMENT DECISIONS	Questions	INVESTMENT DECISIONS
1	HW Typed	31	HW Typed	61	CW
2	Handwritten solution provided	32	Handwritten solution provided	62	CW
3	HW Typed	33	CW	63	HW Typed
4	CW	34	CW	64	HW Typed
5	CW	35	Handwritten solution provided	65	HW Typed
6	Handwritten solution provided	36	Handwritten solution provided	66	HW Typed
7	HW Typed	37	HW Typed	67	CW
8	CW	38	CW	68	CW
9	HW Typed	39	CW	69	HW Typed
10	HW Typed	40	CW	70	HW Typed
11	HW Typed	41	HW Typed	71	CW
12	HW Typed	42	CW	72	CW
13	CW	43	CW	73	HW Typed
14	Handwritten solution provided	44	CW	74	CW
15	Handwritten solution provided	45	CW	75	Handwritten solution provided q 54
16	CW	46	CW		
17	Handwritten solution provided Partial	47	CW		
18	HW Typed	48	CW		
19	HW Typed	49	CW		
20	HW Typed - Discussed in class	50	CW		
21	Handwritten solution provided	51	CW		
22	CW	52	CW		
23	HW Typed	53	CW		
24	CW	54	CW		
25	CW	55	CW		
26	CW	56	HW Typed		
27	CW	57	CW		
28	CW	58	HW Typed		
29	CW	59	CW		

30	CW	60	HW Typed		

Sol (2)

Project A

Initial Investment = ₹1,50,000

Inflows

Years	CFAT	Cummulative CFAT
1	—	—
2	—	—
3	5000	5000
4	20000	25000
5	50000	75000
6	1,50,000	2,25,000
7	50,000	
8	40,000	

$PBP = 5 + \frac{(1,50,000 - 75000)}{1,50,000}$

$= 5 + 0.5$

PBP = 5.5 years

or

$PBP = 5 + \frac{(1,50,000 - 75000)}{1,50,000} \times 12M$

PBP = 5 years & 6 Months

Project B

Initial Investment = ₹1,50,000

Inflows

Years	CFAT	Cummulative CFAT
1	40000	40,000
2	50000	90,000
3	1,20,000	2,10,000
4	10000	
5	10,000	
6	—	
7	—	
8	—	

$PBP = 2 + \frac{(1,50,000 - 90000)}{1,20,000}$

PBP = 2 + 0.5

PBP = 2.5 years

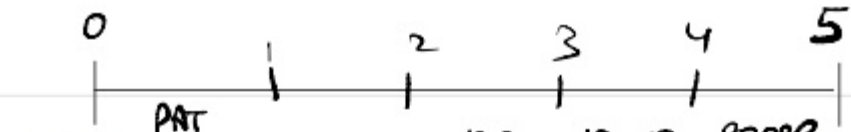
or

$PBP = 2 + \frac{(1,50,000 - 90000)}{1,20,000} \times 12M$

PBP = 2 years & 6 Months

Decision: we should Prefer Project B as it has shorter PBP (2.5 years) as Compared to Project A (5.5 years)

Sol 4



Type ①

$$ARR = \frac{\text{Average PAT}}{\text{Initial Investment}} = \frac{\left(\frac{50{,}000+75000+125000+130000+80000}{5}\right)}{10{,}00{,}000}$$

$$= \frac{92000}{10{,}00{,}000} \times 100 = 9.2\%$$

Type ②

$$ARR = \frac{\text{Average PAT}}{\text{Avelge Investment}} = \frac{92000}{\left(\frac{10{,}00{,}000+80000}{2}\right)}$$

$$\Rightarrow \frac{92000}{540000} \times 100 = 17.03\%$$

Q15

Step① Average PAT = $\frac{80000+80000+80000}{3} = 80000$

Type① $ARR = \frac{\text{Average PAT}}{\text{Initial Investment}} = \frac{80,000}{3,00,000} \times 100 = 26.67\%$

Type② $ARR = \frac{\text{Average PAT}}{\text{Average Investment}} = \frac{80,000}{\left(\frac{300000+90000}{2}\right)} = 41.03\%$

Type③ Step① Calculate ARR of each year seperately using Initial Investment

$ARR_1 = \frac{PAT_1}{\text{Initial Invt}_0} = \frac{80,000}{3,00,000} \times 100 = 26.67\%$

$ARR_2 = \frac{PAT_2}{\text{Initial Invt}_1} = \frac{80,000}{2,30,000} \times 100 = 34.78\%$

$ARR_3 = \frac{PAT_3}{\text{Initial Invt}_2} = \frac{80,000}{1,60,000} \times 100 = 50\%$

Step② Calculate Average of all ARR.

$$ARR = \frac{ARR_1 + ARR_2 + ARR_3}{3} = \frac{26.67 + 34.78 + 50}{3}$$

$$ARR = 37.15\%$$

Type④

Step① Calculate ARR of each year, using average Investment as base

$$ARR_1 = \frac{80,000}{\left(\frac{3,00,000 + 2,30,000}{2}\right)} = 30.18\%$$

$$ARR_2 = \frac{80,000}{\left(\frac{2,30,000 + 1,60,000}{2}\right)} = 41.02\%$$

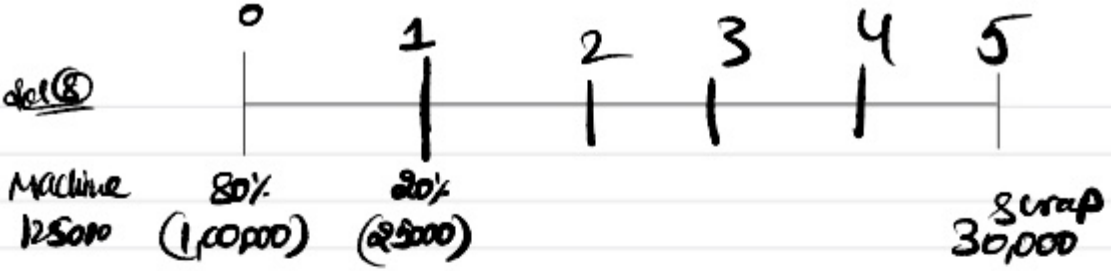
$$ARR_3 = \frac{80,000}{\left(\frac{1,60,000 + 90,000}{2}\right)} = 64\%$$

Step② Now Calculate Average of ARR_3

$$ARR = \frac{30.18\% + 41.02\% + 64\%}{3} = 45.06\%$$

Sol(6) Statement for Calculation of PV

Particulars	year	PV factor 10%	Amt	PV
outflow	0	1	1,00,000	(1,00,000)
Inflows CFAT	1	0.909	55000	49995
	2	0.826	80,000	66080
	3	0.751	15000	11265
			NPV	27340



each year
Production = 50,000 units

Sales = 50000 × 3 = 1,50,000
− Direct cost = 50000 × 1.75 = − 87,500
− FC = 40000 → Dep $\left[\frac{125000-25000}{5}\right]$ = −19000
→ Other FC = −21000

Particulars	yr 1	yr 2	yr 3	yr 4	yr 5
Sales	1,50,000	1,50,000	1,50,000	1,50,000	1,50,000
− Direct cost	−87500	−87500	−87500	−87500	−87500
− Other FC	−21000	−21000	−21000	−21000	−21000
− Advertisement	−10000	−15000	×	×	×
EBTxD	31500	26500	41500	41500	41500
− Dep	−19000	−19000	−19000	−19000	−19000
PBT	12500	7500	22500	22500	22500
− Tax 50%	−6250	−3750	−11250	−11250	−11250
PAT	6250	3750	11250	11250	11250
+ Dep	19000	+19000	+19000	+19000	+19000
CFAT	25250	22750	30250	30250	30250

Sol 8(i) when Tax = 50%

Statement for NPV

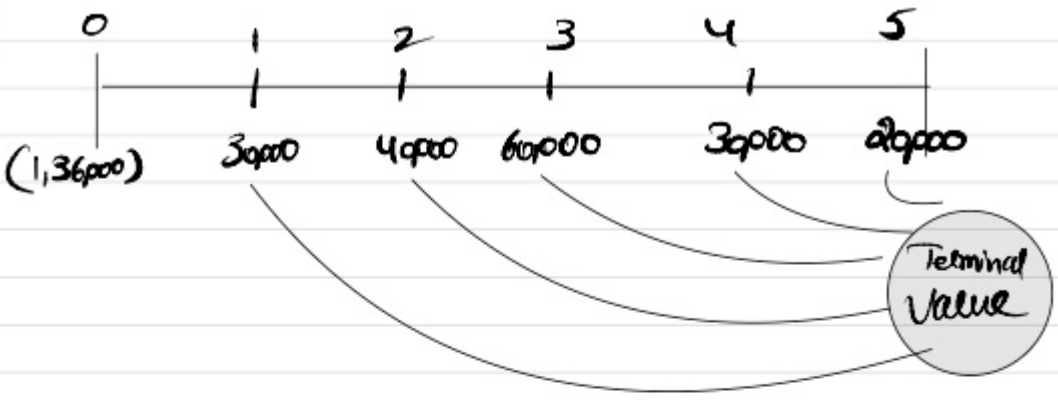
Particulars	yer	PV factor 10%	Amt	PV
outflows				
Purchase of Machine	0	1	1,00,000	(100000)
	1	0.909	25,000	(22725)
Inflows				
Annual CFAT	1	0.909	25250	22954
	2	0.826	22750	18802
	3	0.751	30250	22727
	4	0.683	30250	20661
	5	0.621	30250	18783
Scrap Value	5	0.621	30,000	18628
			NPV	

Sol 8(ii) Ignoring Tax

Statement for NPV

Particulars	yer	PV factor 10%	Amt	PV
outflows				
Purchase of Machine	0	1	1,00,000	(100000)
	1	0.909	25,000	(22725)
Inflows				
Annual CFAT	1	0.909	31500	28634
	2	0.826	26500	21889
	3	0.751	41500	31167
	4	0.683	41500	28345
	5	0.621	41500	25772
Scrap Value	5	0.621	30,000	18630
			NPV	31,712

Sol 13



Step ① Calculation of Terminal value

Year	CFAT	Reinvested upto Terminal
1	30,000	$30,000(1+8\%)^4 = 40815$
2	40,000	$40,000(1+8\%)^3 = 50388$
3	60,000	$60,000(1+8\%)^2 = 69984$
4	30,000	$30,000(1+8\%)^1 = 32400$
5	20,000	$20,000(1+8\%)^0 = 20,000$

Terminal Value = ₹ 2,13,587

Step ②

$$\text{Initial Investment} = \text{Terminal Value} \times \frac{1}{(1+MIRR)^5}$$

$$1,36,000 = 213587 \times \frac{1}{(1+MIRR)^5}$$

$$(1+MIRR)^5 = \frac{213587}{136000} =$$

$$(1+MIRR) = \left(\frac{213587}{136000}\right)^{\frac{1}{5}}$$

∴ MIRR = 9.45%

Q114 outflow = ₹ 20,00,000

EBTαD =	5,50,000
− Depreciation =	− 2,50,000
PBT =	3,00,000
− Tax x 50%	− 1,50,000
PAT =	1,50,000
+ Depreciation	+ 2,50,000
CFAT =	4,00,000

(20L × 12.5%)

Statement for Calculation of Discounted PBP

year	CFAT	PV factor @ 10%	PV	Cummulative PV
1	4,00,000	0.909	3,63,600	3,63,600
2	4,00,000	0.826	3,30,400	6,94,000
3	4,00,000	0.751	3,00,400	9,94,400
4	4,00,000	0.683	2,73,200	

$$\text{Discounted PBP} = 3 \text{ years} + \frac{(10,00,000 - 9,94,400) \times 1}{2,73,200}$$

$$= 3.02 \text{ years (approx)}$$

Sol (15)

Project A

Initial Investment = ₹1,50,000

Inflows

Years	CFAT	Cummulative CFAT
1	—	—
2	—	—
3	5000	5000
4	20000	25000
5	50000	75000
6	1,50,000	2,25,000
7	50,000	
8	40,000	

$PBP = 5 + \frac{(1,50,000 - 75000)}{1,50,000}$

$= 5 + 0.5$

PBP = 5.5 years

or

$PBP = 5 + \frac{(1,50,000 - 75000)}{1,50,000} \times 12M$

PBP = 5 years & 6 Months

Project B

Initial Investment = ₹1,50,000

Inflows

Years	CFAT	Cummulative CFAT
1	40000	40,000
2	50000	90,000
3	1,20,000	2,10,000
4	10000	
5	10,000	
6	—	
7	—	
8	—	

$PBP = 2 + \frac{(1,50,000 - 90000)}{1,20,000}$

$PBP = 2 + 0.5$

PBP = 2.5 years

or

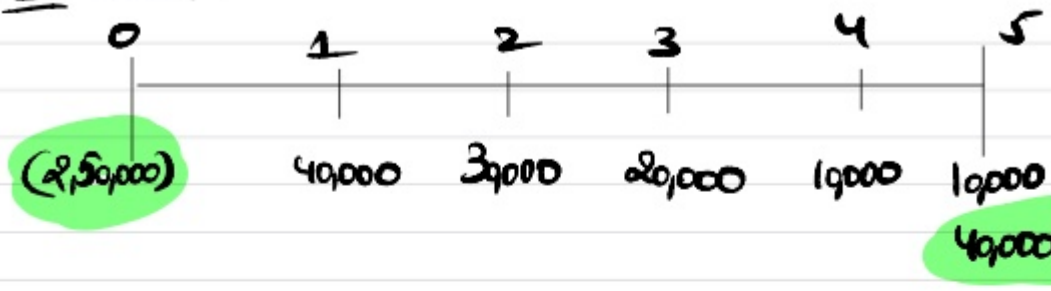
$PBP = 2 + \frac{(1,50,000 - 90000)}{1,20,000} \times 12M$

PBP = 2 years & 6 Months

Decision: we should Prefer Project B as it has shorter PBP (2.5 years) as Compared to Project A (5.5 years)

(I) ARR

Solid wood



$$\text{Average PAT} = \frac{40000+30000+20000+10000+10000}{5} = \frac{110,000}{5}$$

Average PAT = 22000

$$\text{Average capital employed} = \left(\frac{\text{Initial Investment} + \text{Terminal Value}}{2}\right)$$

$$= \left(\frac{2,50,000+40,000}{2}\right) = 145000$$

$$\text{ARR} = \frac{\text{Average PAT}}{\text{Averge CE}} = \frac{22000}{145000} \times 100 = 15.17\%$$

$$\text{Dep each year} = \left(\frac{250000-40000}{5}\right)$$

$$= 42000$$

Sol 16 (II) For PBP Initial Invest = 259000

Year	PAT + Dep. = CFAT	Cummulative CFAT
1	40,000 + 42000 = 82000	82000
2	30,000 + 42000 = 72000	154000
3	20,000 + 42000 = 62000	216000
4	10,000 + 42000 = 52000	268000
5	10,000 + 42000 = 52000 + 40000 = 92000	

$$PBP = 3 + \frac{(250000 - 216000)}{52000} \times 1$$

PBP = 3.65 yrs

Statement of NPV

Particulars	Yr	P/F @ 10%	Amt	PV
outflow	0	1	2,59,000	(259000)
CFAT	1	0.909	82000	
	2	0.826	72000	
	3	0.751	62000	
	4	0.683	52000	
	5	0.621	52000	
Scrap Value	5	0.621	40000	

NPV

Sol (17)

Machine A

Year	CFAT − Dep = PAT
1	40000 − 80,000 = −40000
2	120000 − 80,000 = 40000
3	160000 − 80,000 = 80000
4	240000 − 80,000 = 160000
5	160000 − 80,000 = 80000

WKD Dep for A

$\frac{4,00,000-0}{5} = 80,000$

Average PAT $= \frac{-40000+40000+80000+160000+80000}{5}$

$= 64000$

Initial Investment = 4,00,000

Average Investment $= \frac{4,00,000+0}{2} = 2,00,000$

$ARR \Rightarrow \frac{\text{Average PAT}}{\text{Initial Investment}} = \frac{64000}{4,00,000} \times 100 = 16\%$

&

$= \frac{\text{Average PAT}}{\text{Average Investment}} = \frac{64000}{2,00,000} \times 100 = 32\%$

Note: Earning after tax but before Depreciation means it is CFAT

2/6/20

$$ARR = \frac{\text{Average PAT}}{\text{Initial Investment or Average Investment}}$$

Project A, Initial Investment = ₹10,000

CFAT (Annual)	= 10,000
− Dep = $\left(\frac{10,000-0}{1}\right)$	= 10,000
PAT	= 0

$$ARR = \frac{PAT}{Av\ Invt} = \frac{0}{\left(\frac{10000+0}{2}\right)} = 0\%$$

Project (B)

	1	2
CFAT	7500	7500
− Dep $\left(\frac{10000-0}{2}\right)$	−5000	−5000
PAT	2500	2500

$$ARR = \frac{\text{Average PAT}}{\text{Average Invest}} = \frac{\frac{2500+2500}{2}}{\left(\frac{10000+0}{2}\right)} = \frac{2500}{5000} = 50\%$$

Sol 21 Statement for NPV

Particulars	Years	PV factors @10%	Amount	PV
Outflows				
Initial Investment	0	1	3,06,000	3,06,000
			PVCO (A)	306000
Inflows				
CFAT	1	$\frac{1}{(1.1)^1}$ = 0.909	1,00,000	90900
	2	= 0.826	1,30,000	107380
	3	= 0.751	1,50,000	1,12,650
	4	= 0.683	1,00,000	68,300
			PVCI (B)	3,79,230

NPV = PVCI − PVCO = ₹73230

PI = $\frac{PVCI}{PVCO} = \frac{379230}{306000}$ = 1.24

Sol 22 Statement of NPV

Particulars	yrs	PV factor	Amt	PV
Outflow				
Purchase of Machine	0	1	2,09000	2,09,000
			PVCO (A)	2,00,000
Inflow				
CFAT	1-10	6.145	35000	215075
Scrap value	10	0.386	0	0
			PVCI (B)	215075

NPV = PVCI - PVCO = ₹ 15075

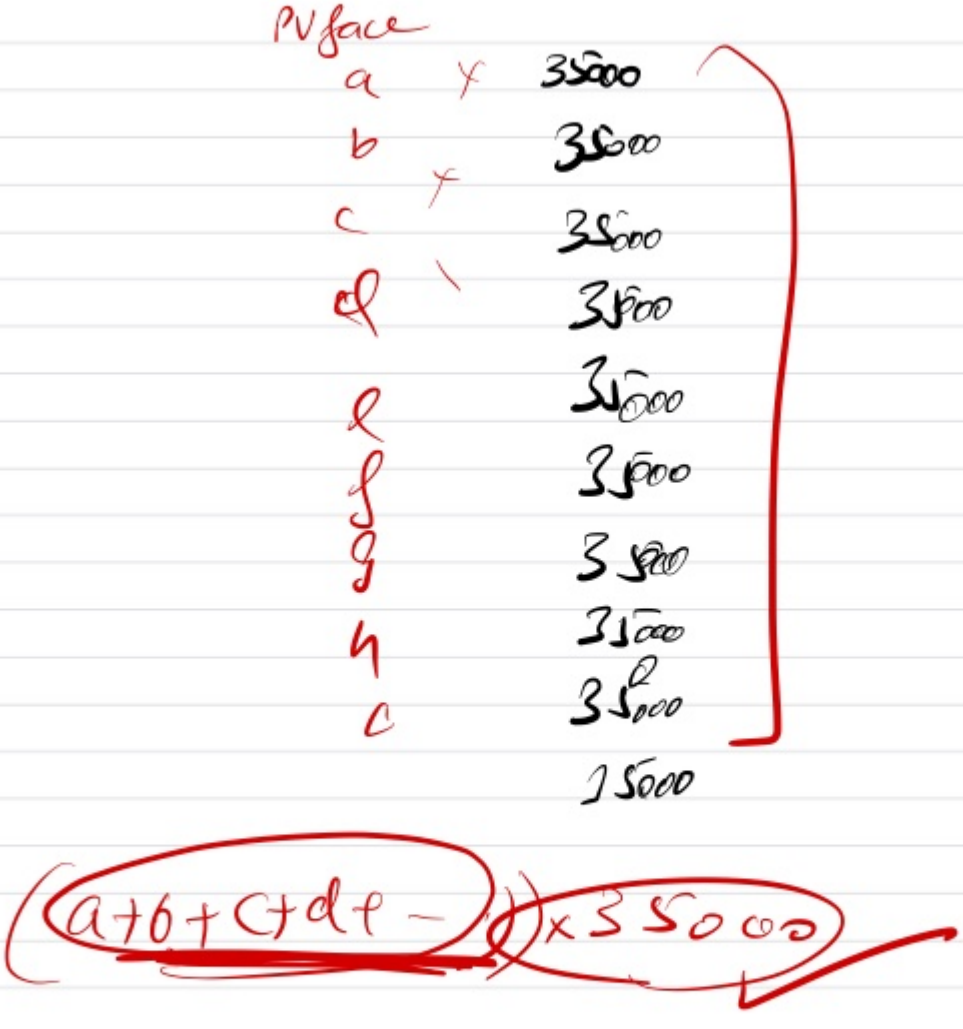
$$PI = \frac{PVCI}{PVCO} = \frac{215075}{2,09000} = 1.08$$

(2) Advice → Yes the company should purchase this new finishing machine because NPV is positive.

1 to 10 yrs

WORK	Revenue	₹ 59000
	− Dep $\left(\frac{2,09000-9}{10}\right)$	− ₹ 29000
	PBT	30,000
	− Tax 50%	−15000
	PAT	15000
	+ Dep	+20,000

CFAT = 35000.


PV face
a
b
c
d
e
f
g
h
35000
35000
35000
35000
35000
35000
35000
35000
35000
15000
(a+b+c+d+e) x 35000

Q.24 (i)

	Project A	Project B	Project C	Project D
outflow	(10,000)	(10,000)	(3500)	(3000)
Inflows				
1	6000	2500	1500	0
2	2000	2500	2500	0
3	2000	5000	500	3000
4	12000	7500	5000	6000
PBP	3 years	3 years	1.8 yrs	3 years

(ii) If standard Payback Period = 2 years,
Then we can only select those proposals which have PBP of less than or equal to 2 years.

→ Select 'Project C' as only this has PBP ≤ 2 yrs.

If standard Payback Period = 3 years
Then all projects can be selected.

(iii)

	A	B	C	D
Discounted PBP	3.17yrs	3.37yrs	2.19yrs	3.18yrs

(a) If Standard Payback period is 2years

→ Reject all Proposals as all have discounted PBP > 2yrs.

(b) If Standard Payback Period is 3years

→ Select Project C as it has Discounted PBP < 3 all other projects should be rejected.

(iv) Calculate NPV → Hue.

2012 (2)

Statement of NPV

Particulars	year	PV factor 11%	Amount	PV.
outflows				
Purchase of P&M	0	1	2,70,500	(2,70,500)
Working Capital	0	1	40,000	(40,000)
Inflows				
CFAT	1	0.9009	70,000	63063
	2	0.8116	1,00,000	81160
	3	0.7312	1,30000	95056
	4	0.6587	90000	59283
	5	0.5935	14500	8605.75
Scrap Value	5	0.5935	5500	3264.25
Recovery of WC	5	0.5935	40,000	23740
			NPV	23672

working	1	2	3	4	5
PBTD	90,000	1,30000	1,70000	1,16000	19,500
~~-Dep~~					
-Tax	-20,000	-30,000	-40,000	-26,000	-5000
~~+Dep.~~					
CFAT	70,000	1,00,000	1,30,000	90,000	14,500

Sol 26

Statement of NPV

Particulars	yr	Amt	At 12%		At 16%	
			PV factor	Amt	PV factor	Amt
Investment	0	400	1	(400)	1	(400)
CFAT	1	120	0.89	106.8	0.86	103.2
	2	112	0.80	89.6	0.74	82.88
	3	115.60	0.71	82.076	0.64	73.984
	4	110.48	0.64	70.707	0.55	60.764
	5	156.92	0.57	89.444	0.48	75.3216
Scrap value	5	0	0.57	0	0.48	0
			NPV	38.62		-3.86

Advice: Accept Proposal as it provides positive NPV

$$IRR = 12\% + \frac{38.62}{38.62-(-3.80)}(16\%-12\%) = 15.64\%$$

Working Particulars	1	2	3	4	5
EBTaD	160	160	180	180	150
- Dep	-80	-64	-51.2	-40.96	-163.84
EBT	80	96	128.8	139.04	(13.84)
- Tax 50%	-40	-48	-64.4	-69.52	+6.92
EAT	40	48	64.4	69.52	(6.92)
+ Dep	80	64	51.2	40.96	+163.84
CFAT	120	112	115.60	110.48	156.92

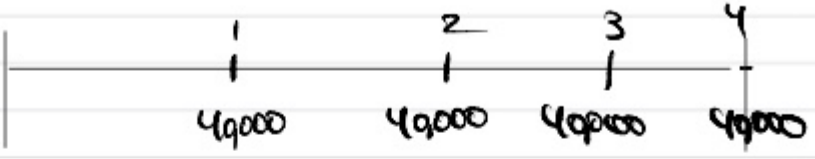
Case ②

Cost =	₹400L
− Dep 1st yr (20%) =	− 80L
WDV =	₹320L
− Dep 20% (2nd yr)	₹64L
WDV =	256L
− Dep 20% (3rd yr)	− 51.2L
WDV	204.8L
− Dep 20% (4th yr)	−40.96
WDV =	163.84
− Dep 5th yr	163.84
Scrap value =	0

→ (Balancing figure) Terminal depreciation ~~20%~~

Sol 27

WN



PVCo = ( )

Step① At IRR = 15%, NPV = 0.

	Year	PVfact (15%)	Amount	PV
Outflow Cost of Project	0	1	x	(x)
Inflow CFAT	1-4	2.855	40,000	1,14,200
			NPV =	0

So, $(x) + 1,14,200 = 0$

$x = 1,14,200$

So, Cost of Project = PVCo = ₹ 1,14,200

Step ② Now calculate NPV at z% (Cost of Capital), So, that PI = 1.064

Particulars	yr	PV factor	Amt	PV
outflow	0	1	1,14,200	(1,14,200)
				PVCO
Inflow CFAT	1-4	? a	40,000	40,000 a
				PVCI

$$PI = \frac{PVCI}{PVCO}$$

$$1.064 = \frac{40,000\ a}{1,14,200}$$

$$\frac{1.064 \times 1,14,200}{40,000} = a$$

$$3.03772 = a$$

$$3.038 = a \quad \text{So, Cost of Capital} = 12\%$$

Fair Calculation Cost of Capital = Discounting rate = 12%

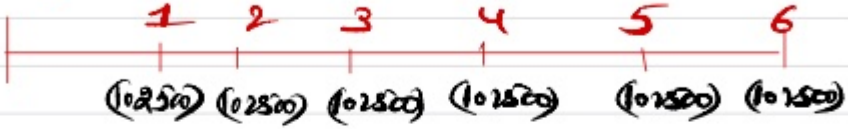
			Discounting At 12%		
outflows	0	1		1,14,200	(1,14,200)
Inflows CFAT	1-4	3.038		40000	121520
				NPV	7320

$$PBP = \frac{\text{Initial outflow}}{\text{Annual inflow}} = \frac{₹1,14,200}{40000} = 2.85 \text{ years.}$$

PBP

Sol 28

Pay in Instalment: $6,15,000 \div 6 = 102500$



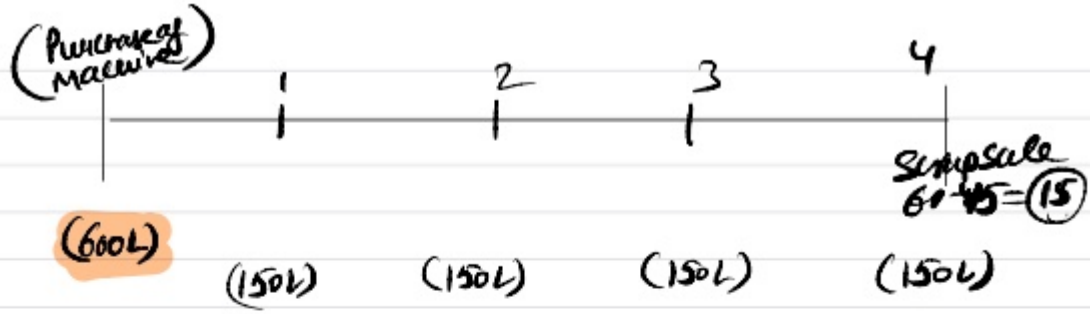
Particulars	yrs	PV factor 12%	Amt	PV
Paid in Instalment	1–6	4.111	102500	421377.5

PVCo (when Paid in Instalment) ⇒ 421,377.5

PVCo (when Paid in one shot) ⇒ ₹500,000.

Advice: we should prefer installment option because it will cost us less than full Payment in beginning.

Q29



WDC

(60L) (105)

Recovery +165

Yani 0 period par WDC = (60L)
But year 1 end tak hume WDC ko 165L pahuchana hai, yani hume jaldi (105L) ki WDC arrange karni hai.

Obviously ab year 1 ke end par WDC = (165L) hogayi
Yehi WDC year 2 ke end and year 3 ke end par maintain karni hogi.

WDV

	1	2	3	4
wages	225	225	255	300
- overtime	-45	-30		
	180	195	255	300

Statement of NPV

(₹ in lakhs)

Particulars	yr	Rs fa	Amt	PV
outflow				
Purchase of Machine	0	1	600	(600)
Payment of Penalty	0	1	90	(90)
Investment in WC (Nadeem)	0	1	60	(60)
" " "	1	0.877	105	(92.085)
			PVCO (A)	842.085
CFAT	1	0.877	469.2	411.488
	2	0.769	416.4	320.212
	3	0.674	453.6	305.726
	4	0.592	382.2	226.262
Sale of Machine	4	0.592	15	8.88
WC recovered	4	0.592	165	97.68
			PVCI (B)	1370.248
			NPV = (B) − (A)	528.163

WN (3)

Particulars	yr 1	yr 2	yr 3	yr 4
Saving in Disposal	150	150	150	150
Sales	966	966	1254	1254
− Material	− 90	−120	− 255	−255
− wages	(225 −45) −180	(225 −30) = 195	− 255	− 300
− other exp	−120	−135	−162	−210
− factory ins (Insurance)	− 90	−90	−90	−90

-opportunity cost of rent	-30	-30	-30	-30
- Depreciation	-150	-114	-84	-63
PBT	456	432	528	456
- Tax 30%	-136.8	-129.6	-158.4	-136.8
PAT				
+ Depreciation	+150	+114	+84	+63
CFAT	469.2	416.4	453.6	382.2

* General OH apportioned are ignored (not relevant) But the relevant OH of Insurance is treated.

Q30 Math Solution

Particulars	Yr	PV factor (15%)	Machine A		Machine B	
			Amt	PV	Amt	PV
Purchase of machine	0	1	5,00,000	5,00,000	5,00,000	5,00,000
– Sale of old	0	1	1,00,000	(1,00,000)	1,00,000	(1,00,000)
Utilities Increased	0	1	1,00,000	1,00,000	2,00,000	2,00,000
Sale of old utilities	0	1	×	×	20,000	(20,000)
			PVCO (A)	5,00,000	PVCO (A)	5,80,000
Inflows CFAT	1	0·87	1,00,000	87,000	2,00,000	
	2	0·76	1,50,000	1,14,000	2,10,000	
	3	0·66	1,60,000	1,18,800	1,80,000	
	4	0·57	2,00,000	1,14,000	1,70,000	
	5	0·50	1,70,000	85,000	40,000	
Scrap Sale	5	0·50	50,000	25,000	60,000	
			PVCI (B)	5,43,800	PVCI (B)	
			NPV (B) – (A)	43800		

Rest of this Question is HW.

Sol 30

Old Machine
Replace

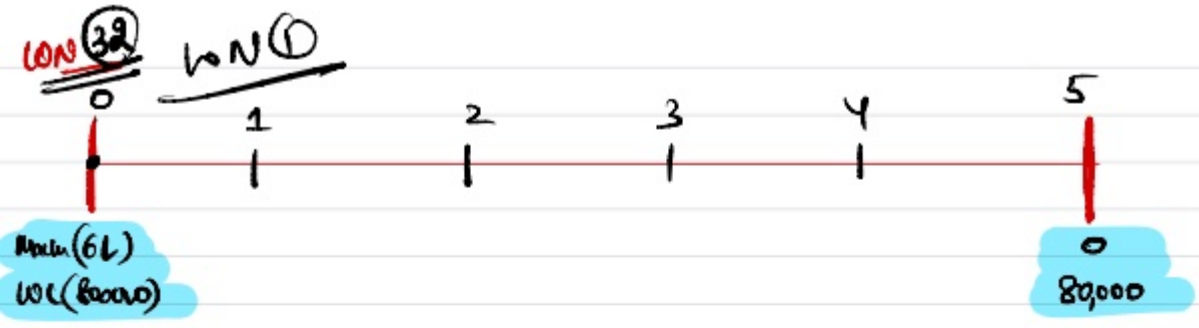
Machine A

Cost	5L
- Sale of old Machine	(1L)
Old utilities + New utilities Buy	use ✓ 1,00,000

Machine B

cost	5L
Sale of old	(1L)
Old utilities + New utilities Buy	~~use~~ sell ✓ (90000)* 2,00,000

Q.N (32)



PBTD	240,000	275,000	2,10,000	1,80,000	1,60,000
-Dep $\left(\frac{6L-0}{5}\right)$	-1,20,000	-1,20,000	-1,20,000	-1,20,000	-1,20,000
PBT	1,20,000	1,55,000	90,000	60,000	40,000
-Tax 35%	-42000	-54250	-31500	-21000	-14000
PAT	78,000	100750	58500	39000	26000
+Dep	+1,20,000	+1,20,000	+1,20,000	+1,20,000	+1,20,000
CFAT	1,98000	2,20,750	1,78,500	1,59,000	146000

Q.N (2)

Statement for NPV

Particulars	Year	PV factor @12% (I)	Amt (II)	PV (II) × (I)	PV factor @15% (IV)	PV (II) × (IV)
Outflows						
Purchase of Machine	0	1	6,00,000	6,00,000	1	6,00,000
WC/Working Capital	0	1	80,000	80,000	1	80,000
			PVCO (A)	6,80,000	PVCO (A)	6,80,000
Inflows						
CFAT	1	0.8929	1,98000	176794	0.8696	1,72,181
	2	0.7972	2,20750	175982	0.7561	166909
	3	0.7118	1,78,500	127056	0.6575	117364
	4	0.6355	1,59,000	101045	0.5718	90916
	5	0.5674	1,46,000	82840	0.4972	72591
WC	5	0.5674	80000	45392	0.4972	39776
			PVCI (B)	709109	PVCO (B)	659737

NPV = 29109 (+)

NPV = (20863) (−)

① Statement for Discounted PBP

Year	Discounted CFAT	Cummulative Discounted CFAT
1	176794	176794
2	175982	352776
3	127056	479832
4	101045	580877
5	82840 + 45392 ⇒ 128232	709109

Initial outflow = 6,80,000

Discounted PBP = $4\text{yrs} + \frac{(6,80,000 - 580877)}{128232} \times 1$

⇒ 4.77 years

② Statement for PBP

Initial Investment = 6,80,000

Year	CFAT	Cumulative CFAT
1	1,98000	1,98000
2	220750	418750
3	178500	597250
4	159000	756250
5	146000 + 80,000 = 226,000	

PBP = $3\text{yrs} + \frac{(6,80,000 - 597250)}{159000}$

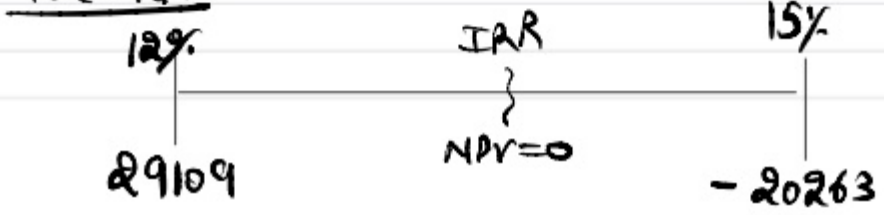
= 3.52 years

③ NPV = PVCI − PVCO

= 709109 − 680000

NPV = 29,109

④ For IRR

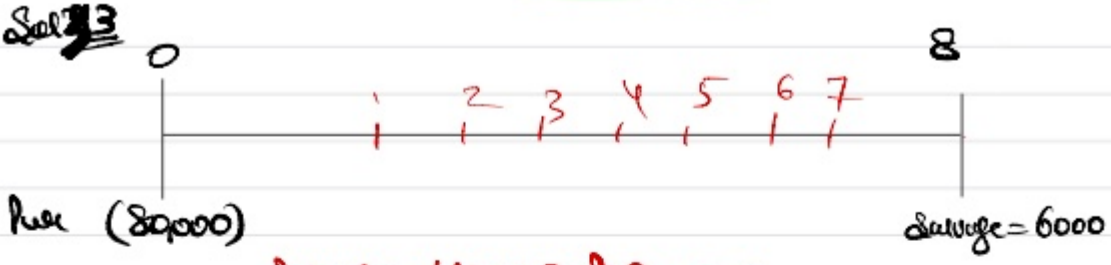


$$IRR = 12\% + \frac{29109}{(29109) - (-20263)} \times (15\% - 12\%)$$

$$= 12\% + \frac{29109}{49372} \times 3\% = \boxed{13.77\%}$$

Let us assume Tax rate = 40%

Sol 13



Revenue = 40,000 P.a - -
- operating cost = 7500 P.a

Revenue =	₹40,000
- operating cost	- ₹ 7500
- Depreciation $\left(\frac{80000-6000}{8}\right)$	- 9250
PBT	23250
- Tax 40%	- 9300
PAT	13950
+ Dep	+ 9250
CFAT	23200
- (Commission (net of Tax)	-12000
Net CFAT	11,200

it is treated as an expense (Money which could not be earned is Money expensed)

Statement of NPV

Particulars	years	PV factor	Amount	PV
Outflows	0	1	(80000)	(80000)
Inflows				
Net CFAT	1-8	5.334	11,200	59741
Scrap value	8	0.467	6000	2802
			NPV	(17,457)

PVCo = 80,000 , PVCI = 62543

$$PI = \frac{PVCI}{PVCo} = \frac{62543}{80000} = 0.78$$

Advice: Reject Proposal to buy Diagnostic Machine

Note: Commission was given net of Tax, So, this Question Could not be completed without Tax rate.
Thus we have assumed Tax rate in Solution.

Sol 34

Revenue = 40000
− exp = −7500

If Commission is before Tax

Sales =	40,000
− exp =	− 7500
− Commission =	− 12000
− Dep $\left(\frac{80-6}{8}\right)$ =	− 9250
PBT	11250
− Tax 30%	−3375
PAT	7875
+ Dep	9250
CFAT	17125

If Commission is after Tax

Sales =	40000
− exp	− 7500
− Dep	− 9250
PBT	23250
− Tax 30%	6975
PAT	16275
− Commission	−12000
+ Depreciation	9250
CFAT	13525

Statement of NPV

Particulars	yr	PVF@8%	(i) If Commission before Tax Amt	(i) If Commission before Tax PV	(ii) If Commission after Tax Amt	(ii) If Commission after Tax PV
Purchase of Mach	0	1	80000	80000	80000	80000
			PVCO	80000	PVCO	80,000
CFAT	1-8	5.334	17125	91344.75	13525	72142.35
Scrap Value	8	0.467	6000	2802	6000	2802
			PVCI	94146.75	PVCI	74944.35
		NPV ⇒		14146.75		(5055.65)

Sol 35 (i) For PBP

Machine MX

Initial Investment = 8,40,000

Year	CFAT	Cummulative CFAT
1	2,14,000	2,14,000
2	2,40,000	4,14,000
3	1,65,000	5,79,000
4	1,79,000	7,58,000
5	1,65,000	9,23,000
6	1,51,000	

$PBP = 4 + \frac{(8,40,000 - 7,58,000)}{165000}$

$= 4.25$ years

or

= 4 years 3 Months

Machine MY

Initial Investment = 10,20,000

Year	CFAT	Cummulative CFAT
1	238500	238500
2	301500	540000
3	3,15,500	855500
4	245500	11,01,000
5	231500	
6	179,000	

$PBP = 3 + \frac{(10,20,000 - 855500)}{245500}$

$PBP = 3.67$ years

or

= 3 years 8 Months (approx)

(ii) Statement of NPV

Particulars	Years	PV factor	MX		MY	
			Amt	PV	Amt	PV
~~outflows~~						
Initial Investment	0	1	(8,00,000)	(8,00,000)	(10,20,000)	(10,20,000)
~~Inflows~~						
CFAT	1	0.909	2,14,000	194526	238500	216796
	2	0.826	2,00,000	165200	301500	249039
	3	0.751	1,65,000	123915	315500	236941
	4	0.683	1,79,000	122257	245500	167677
	5	0.621	1,65,000	102465	231500	143768
	6	0.564	151,000	85164	179000	100956
Scrap Sale	6	0.564	20,000	11280	30,000	16920
			NPV =	4807	NPV =	112092

(iii) Recommendation → PR Engineering Ltd use use Machine MY.

Because NPV for Machine MY is higher & also because PBP of Machine MY is lower.

WACC

MX

Particulars	year 1	2	3	4	5	6
PBDT	2,59,000	2,29,000	1,89,000	2,09,000	1,89,000	1,69,000
− Dep	−1,39,000	−1,39,000	−1,39,000	−1,39,000	−1,39,000	−1,39,000
PBT	1,29,000	1,00,000	50,000	70,000	50,000	30,000
− Tax 30%	−36,000	−30,000	−15,000	−21,000	−15,000	−9,000
PAT	84,000	70,000	35,000	49,000	35,000	21,000
+ Dep	+1,39,000	+1,30,000	+1,30,000	+1,30,000	+1,30,000	+1,30,000
CFAT	2,14,000	2,00,000	1,65,000	1,79,000	1,65,000	1,51,000

$$\text{Dep}\left(\frac{8,09,000-29,000}{6}\right) = 1,39,000$$

MY

Particulars	1	2	3	4	5	6
PBDT	2,74,000	3,60,000	3,80,000	2,80,000	2,60,000	1,85,000
− Dep	−1,65,000	−1,65,000	−1,65,000	−1,65,000	−1,65,000	−1,65,000
PBT	1,05,000	1,95,000	2,15,000	1,15,000	95,000	20,000
− Tax 30%	−31500	−58500	−64,500	−34,500	−28500	−6000
PAT	73,500	1,36,500	150,500	80,500	66,500	14,000
+ Dep	+1,65,000	+1,65,000	+1,65,000	+1,65,000	+1,65,000	+1,65,000
CFAT	238500	301500	315500	245500	231500	1,79,000

$$\text{Dep} = \left(\frac{19,29,000-3,9000}{6}\right) = 1,65,000$$

Sol 36 Statement of NPV

Particulars	Years	PV factor @ 12%	X Amt	X PV	Y Amt	Y PV
outflow	0	1	10,000	(10,000)	10,000	(10,000)
Inflow	1	0.893	6,500	5804.5	3,500	3125.5
	2	0.797	3,000	2391	3,500	2789.5
	3	0.712	3,000	2136	3,500	2492
	4	0.636	1,000	636	3,500	2226
			NPV	967.5	NPV	633

① @ Simple payback Period

X

Years	CFAT	Cummulative CFAT
1	6500	6500
2	3000	9500
3	3000	12500
4	1000	

$PBP = 2 \text{ years} + \frac{(10,000 - 9500)}{3000} \times 1$

PBP = 2.16 years

Y

Cash outflow = 10,000.

$PBP = \frac{10,000}{3500} = 2.857 \text{ years.}$

(b)

	X	Y
NPV =	₹967.5	₹633

(c) $IRA = \frac{PVCI}{PVCO} = \frac{₹10967.5}{₹10,000}, \frac{₹10,633}{₹10,000}$

$= 1.097, 1.063$

(2) If Projects are independent, we should select both the Projects X & Project Y because both have positive NPV.

(3) If Projects are mutually exclusive, then we can select only one of the projects,

Thus we should select Project X as it has higher positive NPV.

Q.38

(WN(i))

	Machine I	Machine II
	Cost ₹10,00,000	₹15,00,000
Dep	$\frac{(10,00,000-0)}{5 \text{ years}}$ = ₹2,00,000	$\frac{(15,00,000-0)}{6}$ = ₹2,50,000
PBTD	₹3,45,000	₹4,55,000
− Dep	− ₹2,00,000	− ₹2,50,000
PBT	1,45,000	₹2,05,000
− Tax 30%	− 43,500	− 61,500
PAT	101500	1,43,500
+ Dep	+ 2,00,000	+ 2,50,000
CFAT	301500 p.a	393500 p.a

(ii) Statement of NPV

Particulars	yrs	PV factor @12%	Machine I Amount	Machine I PV	Machine II Amount	Machine II PV
outflows	0	1	10,00,000	(10,00,000)	15,00,000	(15,00,000)
CFAT	1-5	3.605	301500	10,86,908		
	1-6	4.111			393500	16,17,679
			NPV	86,908	NPV	1,17,679
÷ Cummulative PV factor				÷ 3.605		÷ 4.111
Equivalent Annual NPV				24108		28625

Decision → Select Machine II, because it provides higher Equivalent Annual NPV.

Solⁿ cont'd

Particulars	X	Y
Income		
Saving in labour	90,000	1,20,000
+ Saving in Scrap	10,000	15,000
− Maintenance	− 7,000	− 11,000
− Indirect Material	− 6,000	− 8,000
− Supervision	− 12,000	− 16,000
− Dep	$\left(\frac{150000-0}{5}\right)$ = − 30,000	$\left(\frac{240000-0}{6}\right)$ − 40,000
PBT	45,000	60,000
− Tax 30%	− 13,500	− 18,000
PAT	31500	42000 ✓
+ Dep	+ 30000	+ 40,000
CFAT	61,500	82,000.

(i) $ARR = \frac{\text{Average PAT}}{\text{Average Investment}}$ or $\frac{\text{Average PAT}}{\text{Initial Investment}}$

for machine X = $\frac{31,500}{\left(\frac{150000+0}{2}\right)}$ or $\frac{31500}{150,000}$

⇒ 42% 21%

for machine Y = $\frac{42000}{\left(\frac{240000+0}{2}\right)}$ or $\frac{42000}{240,000}$

35% 17.5%

(ii)

Particulars	yr	A/factor 10%	X Amt	X PV	Y Amt	Y PV
outflow	0	1	150000	(1,50,000)	2,40,000	(2,40,000)
			PVCo (A)	1,50,000	PVCo (A)	2,40,000
Inflow	1-5	3.791	61,500	233147		
	1-6	4.355			82,000	357110
			PVCI (B)	233147	PVCI (B)	357110
NPV				83,147		117,110
÷ cummulative PV factor/ diff				÷ 3.791		÷4355
Equivalent Annual NPV				21933		26,891

$PI = \frac{PVCI}{PVCo}$ → $\frac{233147}{150000} = 1.55$ $\frac{357110}{240000} = 1.488$

$NPV\ Index = \frac{NPV}{PVCo}$ $\frac{83147}{150,000} = 0.55$ $\frac{117110}{240000} = 0.488$

Sol 40 (I)

	NPV at 10%	IRR
Project C	£4139	26.5%
Project D	£3823	37.6%

Ranking as per NPV — Project C Rank 1, Project D Rank 2

Ranking as per IRR — Project C Rank 2, Project D Rank 1

There is a conflict of ranking.

Reasons

(i) Timining difference of cash flows

As project C gets major cash flows in later part of life, whereas project D gets major cash flows in early part of life.

(ii) Reinvestment rate assumption of IRR.

IRR assumes that intermediate cash flows are invested back at IRR, whereas NPV has more realistic assumption that intermediate cash flows are reinvested at expected rate of Investor (Ke).

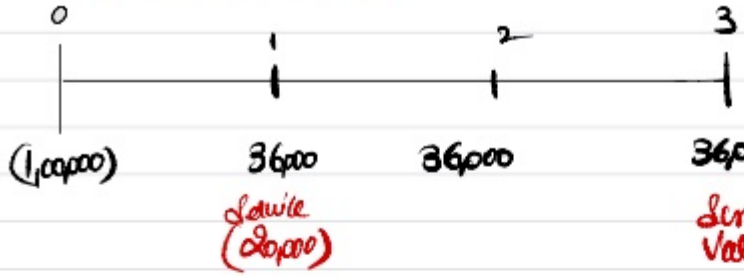
Sol 40 (II) Decision:

Select Project C (which has higher NPV)

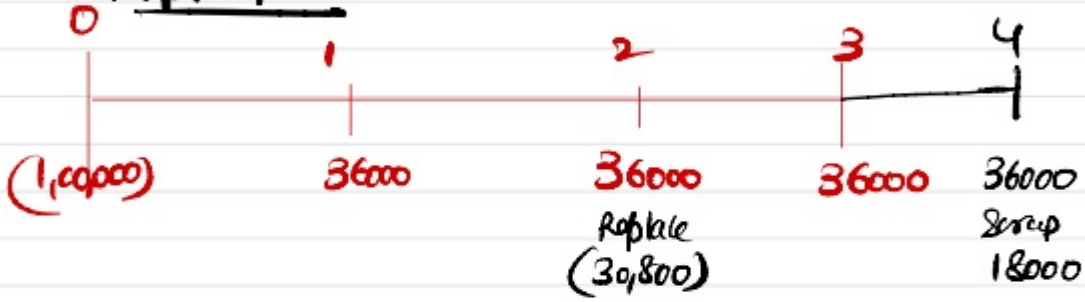
Because Reinvestment rate assumption of NPV is more realistic than IRR, thus we prefer selecting project which has higher cash flows because of higher NPV.

(NPV ranking is better based on wealth maximisation principle)

Q.48 **Service option**



Replace Part



Q.48 (A)

Statement for NPV

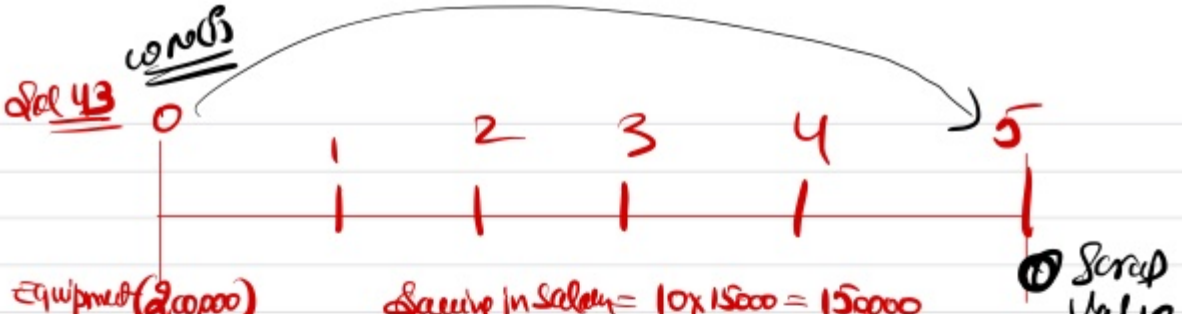
Particulars	yr	PV factor	Service Part		Replace Part	
			Amt	PV	Amt	PV
outflow						
Purchase of Machine	0	1	1,00,000	(1,00,000)	1,00,000	(1,00,000)
Service Machine	1	0.9091	20,000	(18182)	—	—
Replace Part	2	0.8264			30,800	(25453.12)
CFAT	1-3	2.4869	36000	89528.4		
	1-4	3.1698			36000	114112.8
Scrap value	3	0.7513	25000	18782.5		
	4	0.6830			18000	12294
			NPV =	-9874.7	NPV =	953.68
÷ cumulative PV factor life				÷ 2.4869		÷ 3.1698
Equivalent Annual NPV =				-397.069		+300.86

Advice: Replacement of Part is better because it has positive NPV.

(b) If Supplier gives discount of ₹10,000.

	Service Part	Replace Part
Old NPV	−9874.7	953.68
+ Reduced Price	+10,000	+10,000
NPV	125.3	10,953.68
÷ Cumulative PV factor of one	÷ 2.4869	÷ 3.1698
Equivalent Annual NPV =	50.38	3455.64

Sol 43



Equipment (2,00,000)
Initial (50,000)
(2,50,000)

Saving in Salary = 10 × 15000 =	1,50,000
+ Reduced Delay	8,000
+ RM Savings =	12,000
+ Billing Savings =	3,000
Total Savings =	173,000 P.a
− Computer operators (2 × 40000)	− 80,000
− maintenance	− 12,000
− Dep $\left(\frac{250000-0}{5}\right)$	− 50,000
PBT	31,000
− Tax 40%	− 12400
PAT	18,600
+ Dep	+ 50,000
CFAT =	68,600 P.a

Sol 43 Main Solution

(i) Initial Cash outlay = 2,00,000 + 50,000 = ₹2,50,000.

(ii) operating Cash flow for 1 to 5 years = ₹68,600 P.a

Terminal Cash flow = ₹0

(iii) & (iv)

Calculation of NPV & KPI

Particulars	yr	PVf at	Amount	PV
Initial Capital outlay	0	1	2,50,000	(2,50,000)
			PVCo (A)	(2,50,000)
Annual CFAT	1-5	3.605	68,600	247303
Scrap Value	5	0.567	0	0
			PVCI (B)	2,47,303

NPV = PVCI − PVCo = (2697)

$$PI = \frac{PVCI}{PVCo} = 0.989$$

(v) Calculation of Payback Period

Initial Investment = ₹2,50,000
Annual Inflow (CFAT) = ₹68,600

$$\text{Payback Period} = \frac{₹2,50,000}{68,600} = 3.64 \text{ years.}$$

or

= 3 years + 0.64 × 12

= 3 years 8 months (approx)

(vi) At end of 5 years WDV = 0, So, we must have deducted full amount of asset as depreciation.

- Initial Investment = 2,00,000 + 59000 = ₹2,59,000

- Annual CFAT

Savings in labour =	1,59,000
+ Saving in Prod^n delay	8000
+ Saving in Stockout	12,000
+ Saving in Billing	3000
Total Savings	1,73,000
- Salary (2 × 4000)	−80,000
− Maintenance	−12,000
− Dep $\left(\frac{2,59,000-0}{5}\right)$	− 59,000
PBT	31000
− Tax	−12400
PAT	18,600
+ Dep	59,000
CFAT	68,600

- At end

Sale of Asset = 25000
− WDV = 0
CG = 25000

CG Tax 25000 × 40% = 10,000

Sale = 25000
− Tax 10000
Cash in hand 15000

Calculation of NPV

outflow	0	1	2,59,000	(2,59,000)
CFAT	1-5	3.605	68,600	247303
Scrap Sale	5	0.567	15,000	8505
			NPV	5808

(VII) Initial Investment = ₹ 2,59,000.

- CFAT Annual

Savings	173000
− Salary	−89000
− Maintenance	− 12,000
−Dep $\left(\frac{259000-19000}{5}\right)$	−46000
PBT	35000
Tax 40%	−14000
PAT	21,000
+ Dep	+ 46000
CFAT	67,000

- At end

Sale of Asset = 0

− WDV = − 29,000

Capital loss = −29,000

Tax saving on loss = 29,000 × 40% = 8000

Cash Sale = 0

+ Tax Saving + 8000

Terminal Value = 8000

Calculation of NPV

outflow	0	1	2,59,000	(2,59,000)
Annual CFAT	1-5	3.605	67,000	241535
+ Terminal Value	5	0.567	8,000	4536
			NPV	(3929)

Sol 44 cont (i)

Calculation of CFAT

Particular	1	2	3	4	5	6	7	8
Units sold	72000	108000	260000	270000	2,70,000	1,80,000	1,80,000	1,80,000
SP = 120 − VC 60% Cont = 48	×48	×48	×48	×48	×48	×48	×48	×48
Contribution	34,56,000	51,84,000	1,24,80,000	1,29,60,000	1,29,60,000	86,40,000	86,40,000	86,40,000
− FC	−18L	−18L	−18L	−18L	−18L	−18L	−18L	−18L
− Dep 1	−2187500	−2187500	−2187500	−2187500	−2187500	−2187500	−2187500	−2187500
− Dep 2	×	×	×	−2,25,000	−2,25,000	−2,25,000	−2,25,000	−2,25,000
PBT	(531500)	1196500	8492500	8747500	8747500	4427500	4427500	44,27,500
− Tax		1196500 − 531500 665000 × 30% 199500 −199500	−2547750	−2624250	−2624250	−1328250	−1328250	−1328250
PAT	(531500)	997000	5944750	6123250	6123250	3099250	3099250	3099250
+ Dep 1 + Dep 2								
CFAT	1656000	3184500	8132250	8535750	8535750	5511750	5511750	5511750
+ Purchase of Asset			−125000 68,89,250					

Working:

$$\text{Dep}_1 = \frac{(1{,}75{,}00{,}000 - \overset{\text{scrap}}{0} - \text{subsidy})}{8 \text{ year}} = 21{,}87{,}500$$

$$\text{Dep}_2 = \frac{(1250000 - 125000)}{5 \text{ year}^*} = 2{,}25{,}000$$

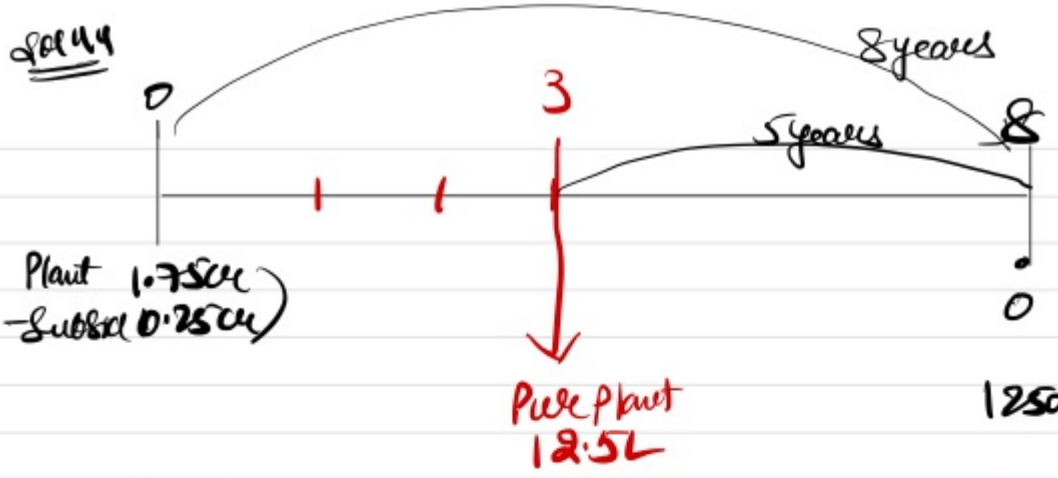
Sol 44 Main Solution

Statement of NPV

Particulars	Year	PV factor	Amount	PV
Outflows				
Purchase of Plant	0	1	1,75,00,000	1,75,00,000
– Subsidy	0	1	–25,00,000	–25,00,000
WC/King Capital	0	1	20,00,000	20,00,000
			PVCo (A)	1,70,00,000
Inflows				
CFAT	1	0.893	16,56,000	1478808
	2	0.797	3184500	2538047
	3	0.712	6882250	4900162
	4	0.636	8535750	5428737
	5	0.567	8535750	4839770
	6	0.507	5511750	2794457
	7	0.452	5511750	2491311
	8	0.404	5511750	2226747
Sale of original Machine	8	0.404	0	0
Sale of New Machine	8	0.404	1,25,000	50500
WC Recovery	8	0.404	20,00,000	808000
			PVCI (B)	27556539
NPV (PVCI – PVCo) (B – A)				105556539

Advice: Accept Proposal.

Sol 44



LOC (20L)

20L LOC released

2015

(cont'd)

Particulars	1	2	3	4	5	6	7	8	9	10
Rate	2.25	2.50	2.75	3.0	3.25	3.50	3.75	4.25	4.75	5.25
x Units	24L	x24L	24L	24L	24L	24L	24L	24L	24L	24L
Sales	54L	60L	66L	72L	78L	84L	90L	102L	114L	126L
-Maintance	-4L	-6L	-8L	-10L	-12L	-14L	-16L	-18L	-20L	-22L
PBT	50	54	58	62	66	70	74	84	94	104
-Tax 50%										
PAT	25	27	29	31	33	35	37	42	47	52
+ Tax Saving on Dep	140L	-	-	-	-	-	-	-	-	-
CFAT	165	27	29	31	33	35	37	42	47	52

Con: Dep yr 1 $\Rightarrow \left(\frac{280L - 0}{1} - \text{Scrap} - \text{Subsidy}\right) = 280L$

Tax Saving on Dep = $280L \times 50\% = \boxed{140L}$

Wind Electricity Generated = 25 Lakh units

Free 4% 1 Lakh unit

Sale 96% (24 L unit)

Q4(5)

Statement of NPV

Particulars	year	Pv factor @ 15%	Amt	PV
Outflows				
Costal land	0	1	30,00,000	30,00,000
Costal PAM (solar)	0	1	2,80,00,000	2,80,00,000
- Subsidy	1	0.870	(25,00,000)	(21,75,000)
Inflows				
CFAT	1	0.870	165,00,000	1,43,55,000
	2	0.756	27,00,000	20,41,200
	3	0.658	29,00,000	19,08,200
	4	0.572	31,00,000	17,73,200
	5	0.497	33,00,000	16,40,100
	6	0.432	35,00,000	15,12,000
	7	0.376	37,00,000	13,91,200
	8	0.327	42,00,000	13,73,400
	9	0.284	47,00,000	13,34,800
	10	0.247	52,00,000	12,84,400
Sale of Solar Plant	10	0.247	0	—
Sale of land	10	0.247	90,00,000	22,23,000
			NPV	20,11,500

Advice: Accept Proposal as it has positive NPV.

Q46 Statement of NPV

Particulars	year	P.V factor	Amount	PV
outflows				
Initial Purchase	0	1	35,00,000	
– Sale of old equipment	0	1	–9,00,000	(26,00,000)
			PVC0 (A)	(26,00,000)
Inflows				
CFAT	1–6	4.108	2,59,000	10,27,000
• Tax Saving on Depreciation	1	0.892	1,75,000	15,61,000
• Sale of Asset	6	0.506	1,00,000	50,600
			PVI (B)	26,38,600

Accept Proposal

NPV = ₹38,600

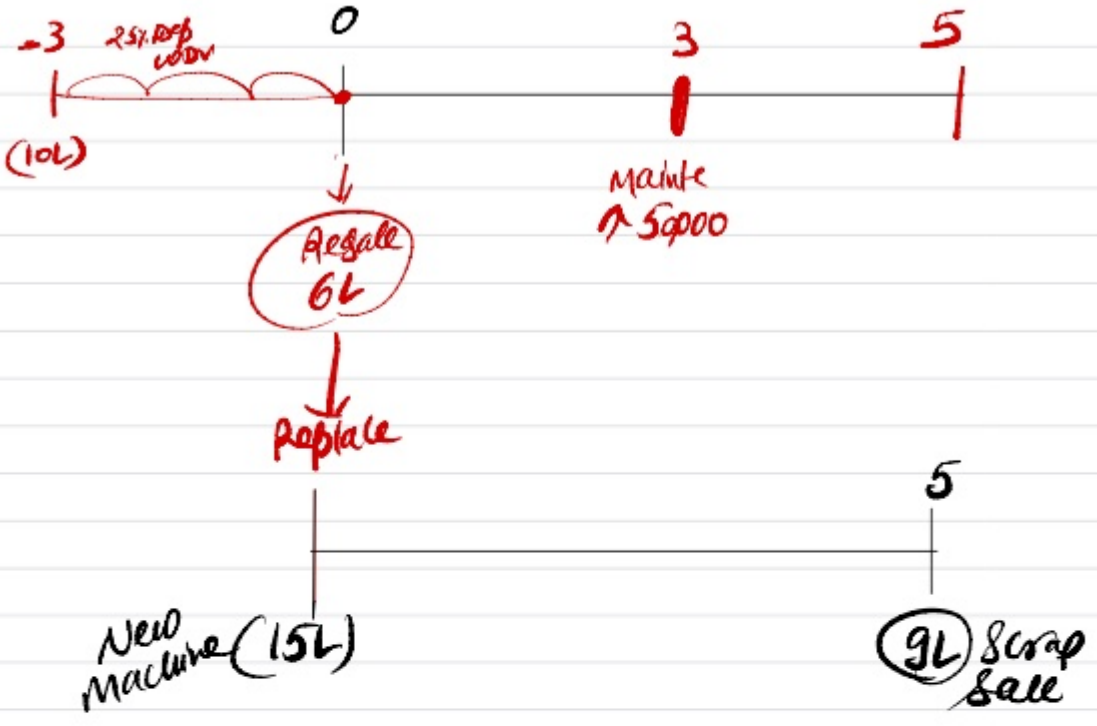
Working (i) Saving (Revenue) = ₹12,00,000
– Maintenance exp – ₹7,00,000
PBT = 5,00,000
– Tax – 2,59,000
CFAT = 2,59,000 (Straight line dep)

Working (ii)

	0	1	2	3	4	5	6
Purchase	(35L)						
Sale							1L Sale

Working (iii) Dep = 35L in beginning year
× Tax rate × 50%
17.5L

Sol 47



WN(1)

Particulars	yr 1	yr 2	yr 3	yr 4	yr 5
Increase in Revenue	1,50,000	1,50,000	1,50,000	1,50,000	1,50,000
Saving in Cost	1,00,000	1,00,000	1,00,000	1,00,000	1,00,000
Saving in Maintenance of old Machine	-	-	+ 50,000	+ 50,000	+ 50,000
Revenue	2,50,000	2,50,000	3,00,000	3,00,000	3,00,000
- Dep	-225000	-168750	-126563	- 94922	- 71191
PBT	25000	81250	173437	205078	228809
- Tax 35%	- 8750	-28438			
PAT 65%	16250	52812			
+ Dep.	+225000	+ 168750	126563	94922	71191
CFAT	241250	221562	239297	228223	219917

WDV (II) Block of Asset concept → (Cost - Scrap) x Dep rate

(Cost - Sale of old machine) x Dep rate

Cost - Sale of old Machine

15L - 6L = 9,00,000

- Dep 1st year 25% - 225000
  WDV = 675000
- Dep 2nd yr 25% - 168750
  WDV 506250
- Dep 3rd yr 25% - 126563
  WDV 379687
- Dep 4th yr 25% - 94922
  WDV 284765
- Dep 5th yr 25% - 71191
  WDV 213574 → Yaha par last year mei full Balance ko Dep nahi karenge

Kyunki Block of Asset concept hai.

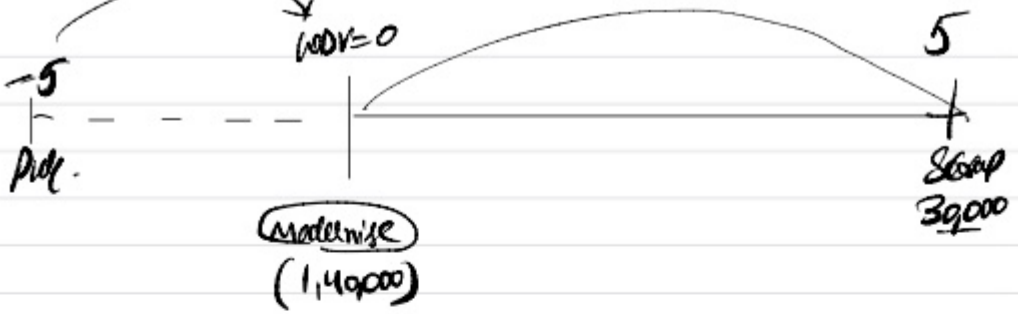
Note: No Capital gain arises, as it is Block of Asset Concept.

Sol47
Mainreduction

Statement of NPV

Particulars	year	PV factor @ 10%	Amount	PV
Outflows				
Purchase of Machine	0	1	1500000	
- Sale of old Machine	0	1	- 600000	(900000)
Inflows				
CFAT	1	0.909	241250	219296.25
	2	0.826	221562	183010.212
	3	0.751	239297	179712.047
	4	0.683	228223	155876.309
	5	0.621	219917	136568.457
Scrap Value	5	0.621	9,00000	558900.
			NPV	533363.275

Savings option①



option②

WN②

	Existing	Modernise	New machine
wages Salary	45000	35500	15000
Supervision	20,000	10,000	7000
Maintenance	25000	5000	2500
Power	30000	20000	15000
Total Exp	1,20000	70,500	39,500
Saving in cost		49,500	80,500

WN ③

	Saving in cst	Modernisation	New Machine
		49500	89,500
– Dep		$\left(\frac{1,40,000-30,000}{5}\right)$ -22000	$\left(\frac{3,50,000-60,000}{5}\right)$ = -58000
PBT		27500	22500
– Tax 50%		-13750	-11250
PAT		13,750	11,250
+ Dep		+22,000	+ 58000
CFAT		35,750	69,250

Statement of NPV

Particulars	yrs	PVfac	Modernisation		Replacement	
			amt	PV	amt	PV
outflow	0	1	1,40,000	(1,40,000)	3,50,000	(3,50,000)
Inflows						
CFAT	1-5	3.790	35,750	135498	69,250	2624575
Scrap vale	5	0.621	30,000	18630	60,000	37260
NPV			NPV	14129.8	NPV	(50825)

Advice: Modernise machine as it provides positive NPV.

Sol 49 cont (ii)

Calculation of CFAT.

Particulars	yr 1	yr 2	yr 3
Sales	10,00,000	20,00,000	8,00,000
– Material consumed	– 4,00,000	– 7,50,000	– 3,50,000
– Overhead (Irrelevant)	– 40,000	– 75,000	– 35000
– Rent Paid (ignored)	– 50,000	– 50,000	– 50000
– Rent opportunity cost	– 37,500	– 37,500	– 37500
– Depreciation	– 3,00,000	– 3,00,000	– 3,00000
PBT	212500	862500	62500
– Tax 50%	– 106250	– 431250	– 31250
PAT	106250	431250	31250
+ Depreciation	+ 3,00,000	+ 3,00000	+ 3,00000
CFAT	4,06,250	7,31,250	3,31,250

Statement of NPV

Particulars	yr	PV factor @ 20%	Amt	PV
Outflows				
Purchase of Machine	0	1	10,80,000	(10,80,000)
Inflows				
CFAT	1	0.833	406250	338406.25
	2	0.694	731250	507487.5
	3	0.579	331250	191793.75
Scrap value	3	0.579	1,80,000	104220
			NPV	61907.5

Advice: Accept Proposal

Sol 49

Q(i)

Required = 25000 Sq. feet

12500 Sq. feet owned space @ ₹3 leased out	12500 Sq. feet x 4 Rent
₹37500	₹50000
↓	↓
opportunity cost	Rent Paid out for additional space taken.

✓ ✓

Q(ii) Machine cost

Purchase	9,00,000
+ Modification	+ 30,000
+ Install	+ 60,000
+ Testing	+ 90,000

Cost of Machine = 10,80,000

Q(iii)

$$Dep = \frac{10,80,000 - 1,80,000}{3} \quad (\text{Scrap})$$

$\Rightarrow$ ₹3,00,000

del 50

Statement of NPV

Particulars	yrs	PV factor	Amount	PV
outflow				
Land cost	0	1	8,00,000	(8,00,000)
Construction cost	0	1	15,00,000	(15,00,000)
Annual CFAT	1	0.87	6,00,000	522000
	2	0.76	7,00,000	532000
	3	0.66	8,00,000	528000
	4	0.57	9,00,000	513000
	5	0.50	10,00,000	5,00,000
Salvage value	5	0.50	—	—
			NPV :	10,95,000

Advice: Accept Proposal

Note:

① Land cost ₹8,00,000 , it's sunk cost as it's already owned.

cont'd

Particulars	yr 1	yr 2	yr 3	yr 4	yr 5
Saving in Alcoma	8,00,000	10,00,000	12,00,000	14,00,000	16,00,000
+Saving in Boarding	50,000	50,000	50,000	50,000	50,000
+ Exec. Training	2,00,000	2,00,000	2,00,000	2,00,000	2,00,000
− Maintenance	−1,50,000	−1,50,000	−1,50,000	−1,50,000	−1,50,000
− Depreciation	−3,00,000	−3,00,000	−3,00,000	−3,00,000	−3,00,000
PBT	6,00,000	8,00,000	10,00,000	12,00,000	14,00,000
− Tax 50%	−3,00,000	−4,00,000	−5,00,000	−6,00,000	−7,00,000
PAT	3,00,000	4,00,000	5,00,000	6,00,000	7,00,000
+ Dep	+3,00,000	+3,00,000	+3,00,000	+3,00,000	+3,00,000
CFAT	6,00,000	7,00,000	8,00,000	9,00,000	10,00,000

Q51 (Main solution)

Statement of NPV

Particulars	Year	Affacting	Amt	PV
Outflows				
• Initial Investment (1st Inst)	0	1	16,00,000	16,00,000
(2nd Inst)	1	0.870	4,00,000	3,48,000
• Installation exp	0	1	1,00,000	1,00,000
			PVC (A)	20,48,000
Inflows				
Annual CFAT	0	1	-2,00,000	(2,00,000)
	1	0.870	8,81,000	766470
	2	0.756	8,95,000	676620
	3	0.658	9,09,000	598122
	4	0.572	9,23,000	527956
	5	0.497	10,37,000	515389
Scrap value	5	0.497	0	0
			PVCI (B)	28,84,557

NPV = PVCI − PVCo = 8,36,557.

$$PI = \frac{PVCI}{PVCo} = \frac{28,84,557}{20,48,000} = 1.41$$

Q.No (9) Statement for CFAT

Particulars	year 0	1	2	3	4	5
Savings in salary		15L	15L	15L	15L	15L
Saving in Inventory		3L	3L	3L	3L	3L
Saving in Post Sale		2.5L	2.5L	2.5L	2.5L	2.5L
Saving in Billing		2L	2L	2L	2L	2L
Less						
• Salary (5L×2)		(10L)	(10L)	(10L)	(10L)	(10L)
• Maintenance cost		(2L)	(1.8L)	(1.6L)	(1.4L)	(1.2L)
• Depreciation $(\frac{21L-0}{5})$		(4.2L)	(4.2L)	(4.2L)	(4.2L)	(4.2L)
PBT		6.3	6.5	6.7	6.9	7.1
− Tax 30%						
PAT		4.41	4.55	4.69	4.83	4.97
+ Dep		4.2	4.2	4.2	4.2	4.2
+ Maintenance cost		+2L	+1.8	+1.6	+1.4	+1.2
− Maintn cost	−2	−1.8	−1.6	−1.4	−1.2	x
CFAT	−2	8.81	8.95	9.09	9.23	10.37

Sol 52 Let Value of New Machine is ₹x.

Particulars	Year	PV factor	Amount	PV
Initial Purchase of Machine	0	1	x	
less Sale of old Machine	0	1	-5,00,000	x-5,00,000
			PVCo (A)	x-5,00,000
CFAT				
	1	0.87	60,000	52,200
	2	0.76	1,20,000	91,200
	3	0.66	1,80,000	1,18,800
	4	0.57	2,40,000	1,36,800
	5	0.49	3,00,000	1,47,000
Sale of Machine			0	
Tax Saving on Dep	1-5	3.35	0.08x-40000	0.268x-134000
			PVCI (B)	0.268x+412000
			NPV (B)-(A)	4,53,000

PVCI - PVCo = NPV

$(0.268x - 412000) - (x - 500000) = 453000$

So, $x = 7627049$

Working

Particulars	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
output level achieved	60%	70%	80%	90%	100%
- output with existing	-50%	-50%	-50%	-50%	-50%
output because of New	10%	20%	30%	40%	50%
x Capacity	x1,00,000	x1,00,000	x1,00,000	x1,00,000	x1,00,000
Output	10000	20,000	30,000	40,000	50000
x Cont Pu (30-15)	x15	x15	x15	x15	x15
Contribution (Incremental)	1,50,000	3,00,000	4,50,000	6,00,000	7,50,000
- Fixed Cost (Incremental)	-50,000	-1,00,000	-1,50,000	-2,00,000	-2,50,000
PBT	1,00,000	2,00,000	3,00,000	4,00,000	5,00,000
- Tax 40%	-40,000	-80,000	-1,20,000	-1,60,000	-2,00,000
Incremental PAT	60,000	1,20,000	1,80,000	2,40,000	3,00,000

WN ② Dep each year

Normal Depreciation:

$$\frac{x-0}{5} = \frac{\text{cost} - \text{Scrap}}{n}$$

Block of Asset Concept.

$$\text{Dep} = \frac{x-50000}{5} = \frac{\text{cost} - \text{Sale of old machine}}{n}$$

Tax saving on Dep = Dep × tax rate

$$\Rightarrow \left(\frac{x-50000}{5}\right) \times 40\%$$

$$\Rightarrow \frac{40\% \times x}{5} - \frac{50000 \times 40\%}{5}$$

$$\Rightarrow 8\%x - 40{,}000$$

Tax saving on depreciation ⇒ $\boxed{0.08x - 40{,}000}$ each year

Note:

① Iss question ko hum incremental concept se kar rahe hai kyunki, purani machine 50% output toh produce kar hi rahi thi,

New machine buy karne ya nahi yeh decision sirf additional output ke basis par hoga.

Sol 52(b) Statement of NPV

Particulars	Yrs	N factor	Amt	PV
outflows				
Purchase of Machine	0	1	627049	
less Sale of old	0	1	-500000	127049
			PVCO (A)	127049
Inflows				
Incremental CFAT	1	0.87	70164	61043
	2	0.76	190164	144525
	3	0.66	310164	204706
			PVCI (B)	410274
			NPV	283225

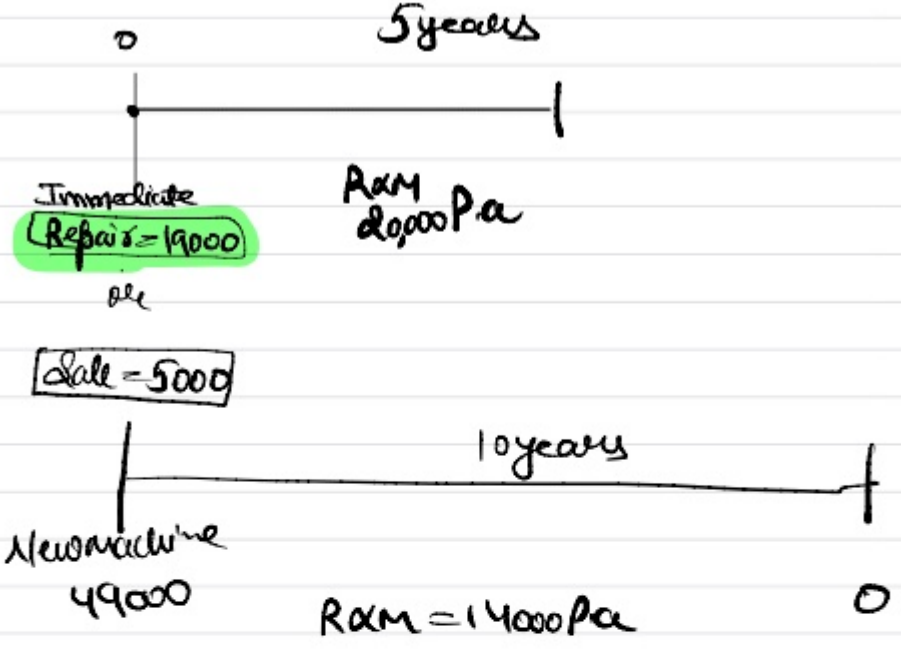
Comment: Managing director is correct

(cont'd)

Particulars	Yr 1	Yr 2	Yr 3
output	60%	80%	100%
- Previous Machine output	-50%	-50%	-50%
Incremental output	10%	30%	50%
x Capacity	x 1,00,000	x 1,00,000	x 1,00,000
Incremental qty	10000	30000	50000
x Cont PU	x 15	x 15	x 15
Incremental Cont	1,50000	4,50000	7,50000
- FC	-50000	-2,50000	-2,50000
PBT & Dep	1,00000	3,00000	5,00000
- Dep [(627049 - 50000)/5]	-25410	-25410	-25410
PBT	74,590	2,74,590	4,74,590
- Tax x 40%	-29836	-109836	-189836
PAT	44754	164754	284754
+ Dep	+25410	+25410	+25410
CFAT	70164	190164	310164

Q153

cont(i)



Case(i) If we repair & use old Machine

Particulars	Yr	PV factor	Amt	PV
outflows				
Immediate Repair 19000 (1-50%)	0	1	9500	9500
Annual RAM 20,000 (1-50%)	1-5	3.791	10,000	37910
			PVCO	47410
			÷ Cummulative PV factor	÷3.791

Equivalent Annual PVCO = ₹12506 ✓

Case ② If we Buy new machine

Particulars	yr	PV factor	Amt	PV
Buy machine	0	1	49000	
Sale of old Machine	0	1	-5000	44000
Annual R&M 14000 (1-50%)	1-10	6.145	7000	43015
Tax Savings on Dep $\frac{(49000-0)}{10}$ Dep × tax rate @ 50%	1-10	6.145	2450	(15055.25)
			PVCO	71959.75
		÷ cumulative	PV factor	÷ 6.145
Equivalent Annual PVCO				11710 ✓

Advice: The Company should buy new machine, because it has lower Equivalent Annual PVCo.

Sol 54

	year	P/factor	Amt	PV
Initial cost	0	1	18,00,000	18,00,000
Annual Maintenance	1-8	4.4873	2,00,000	8,97,460
less Scrap Sale	8	0.3269	4,00,000	(1,30,760)
PV Co				25,66,700
÷ Cummulative PV factor for 8 years				÷ 4.4873
Equivalent Annual PV (Cost) of New = ₹5,71,992				

option I If we Replace Today (Immediately)

Maintenance cost on old Machine	= 0
Sale of old Machine	= 8,00,000
Equivalent Annual Cost of New Machine	= (571992)
Net Amount	= ₹2,28,008

option II If we Replace at end of 1st Year.

Particulars	yr	P/fac	Amt	PV
Maintenance cost	1	0.8696	(2,00,000)	(173920)
Sale of old	1	0.8696	5,00,000	434800
EAC of New	1	0.8696	(571992)	(497404)
			Net PV	(236524)

option (III) If we Replace at end of 2nd year.

Maintenance cost	1	0.8696	2,00,000	(173920)
	2	0.7561	4,00,000	(302440)
Sale of old	2	0.7561	3,00,000	226830
EA Cost new	2	0.7561	571992	(432483)
			Net PV	(682013)

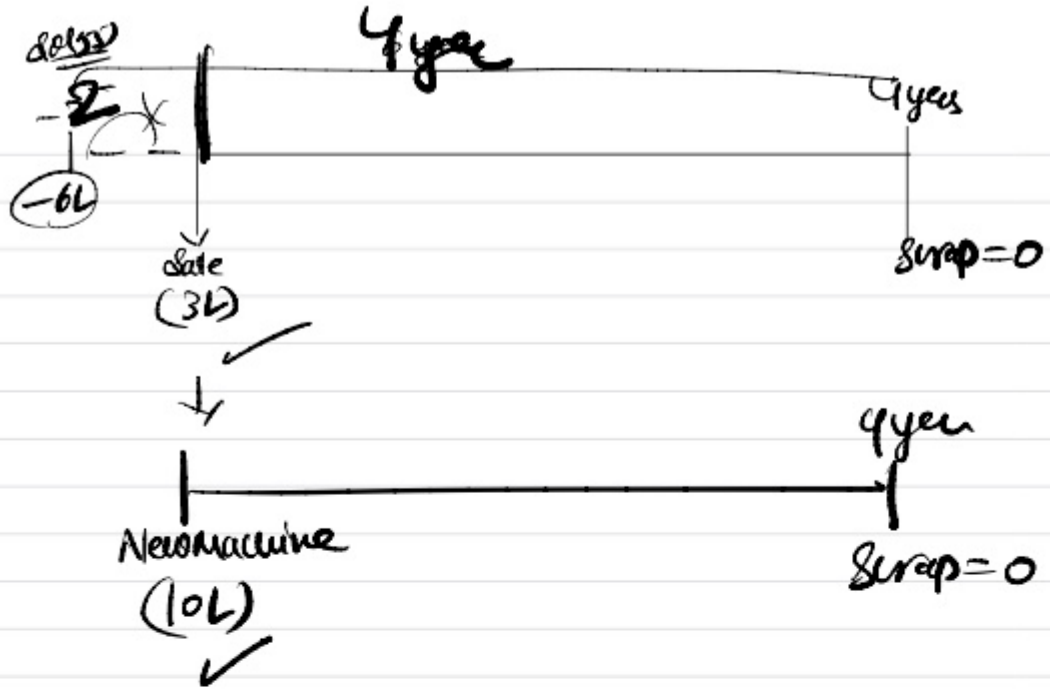
option (IV) If we replace at end of 3rd year.

Maintenance cost	1	0.8696	2,00,000	(173920)
	2	0.7561	4,00,000	(302440)
	3	0.6575	6,00,000	(394500)
Sale of old	3	0.1575	2,00,000	+131500
EA Cost new	3	0.6575	571992	(376085)
			Net PV	(11,15,445)

option (V) If we Replace at end of 4th year

Particulars				
maintenance	1	0.8696	2,00,000	(173920)
	2	0.7561	4,00,000	(302440)
	3	0.6575	6,00,000	(394500)
	4	0.5718	8,00,000	(457440)
Sale of old	4	0.5718	0	0
EA Cost new	4	0.5718	571992	(327065)
			Net PV	(16,55,365)

Advice: Replace immediately.



Statement of NPV

Particulars	Year	Dfact	Amount	PV
Purchase of New Machine	0	1	10,00,000	
-Sale of old machine	0	1	(3,00,000)	(7,00,000)
Incremental WC	0	1	1,00,000	(1,00,000)
Inflow				
Incremental Cash flow	1-4	3.169	217000	687673
Tax saving on Dep.				
1,40,000 p 30%	1	0909	42000	38178
112000 p 30%	2	0.826	33600	27754
89600 p 30%	3	0.751	26880	20187
71680 p 30%	4	0.683	21504	14687
Incremental WC	4	0683	1,00,000	68300
			NPV	56,779

		Existing	New
WN (ii)			
output =	300 x 6 x 20 = 36000 units (300 days few)		300 x 6 x 40 = 72000 units
Sale value @ 10 =		₹ 360000	₹ 720000
− Material @ 2 =		− ₹ 72000	− ₹ 144000
− Labour	300 x 6 x 20 =	− ₹ 36000	300 x 6 x 30 = ₹ 54000
− Fixed OH		− ₹ 100000	− ₹ 60000
PBT		₹ 152000	₹ 462000
− Tax 30%		− 45600	− ₹ 138600
CFAT		106400	₹ 323400

Incremental CFAT (217000)

WN (iii) Block of Asset

Incremental Depreciable amt = (1000000 − 300000)	= 700000
− Dep 1st yr 20%	− 140000
WDV =	560000
− Dep 2nd yr 20%	− 112000
WDV	448000
− Dep 3rd yr 20%	89600
WDV	358400
− Dep 4th yr 20%	− 71680
WDV	286720

Q157 (A) without Tax

Statement for Equivalent Annual PVCo

Particulars	yr	PV factor (10%)	Machine A (3yrs)		Machine B (2yrs)	
Purchase cost	0	1	1,50,000	1,50,000	1,00,000	1,00,000
Running exp	1-3	2.487	40,000	99,480		
	1-2	1.736			60,000	1,04,160
− Tax saving on DEP			−	−	−	−
			PVCo	2,49,480		2,04,160
÷ Cumulative PV for life				÷ 2.487		÷ 1.736
Equivalent Annual PVCo				(100314)		(117603)

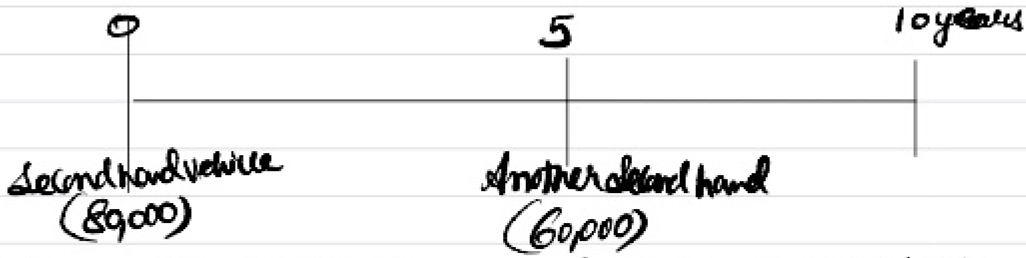
Q157 (B) with 30% Tax

Statement for Equivalent Annual PVCo

Particulars	yr	PV factor (10%)	Machine A (3yrs)		Machine B (2yrs)	
Purchase cost	0	1	1,50,000	1,50,000	1,00,000	1,00,000
Running exp (1−t)	1-3	2.487	40000 (1−30%) = 28000	69636		
	1-2	1.736			60000 (1−t) = 42000	72912
− Tax Saving on DEP (Dep × tax rate)	1-3	2.487	(50000 × 30%) = 15000	(37305)		
	1-2	1.736	−	−	−15000	(26040)
			PVCo	182331		146872
÷ Cumulative PV for life				÷ 2.487		÷ 1.736
Equivalent Annual PVCo				(73314)		84604

Advice: Select Machine A, Because it has lower Equivalent Annual PVCo.

Sol 59



Step ① Calculation of Tax Saving on Depreciation

Purchase New Machine

Year	WDV	25% Dep	× Tax 30% =	Tax Saving on Dep
1	1,50,000	37500	× 30%	11250
2	112500	28125	× 30% =	8437
3	84375	21094	× 30% =	6328
4	63281	15820	× 30% =	4746
5	47461	11865	× 30% =	3560
6	35596	8899	× 30% =	2670
7	26697	6674	× 30% =	2002
8	20023	5006	× 30% =	1502
9	15017	3754	× 30% =	1126
10	11263	2816	× 30%	845

WDV = 8447 → Scrap sale value

Purchase Second hand

Year	WDV	25% Dep	× Tax 30% =	Tax Saving
1	80,000	20,000		6000
2	60,000	15000		4500
3	45000	11250		3375
4	33750	8437		2531
5	25313	6328		1898
	18985 → Scrap Sale			
6	60,000	15000		4500
7	45000	11250		3375
8	33750	8437		2531
9	25313	6328		1898
10	18985	4746		1424
	14239 → Scrap Sale			

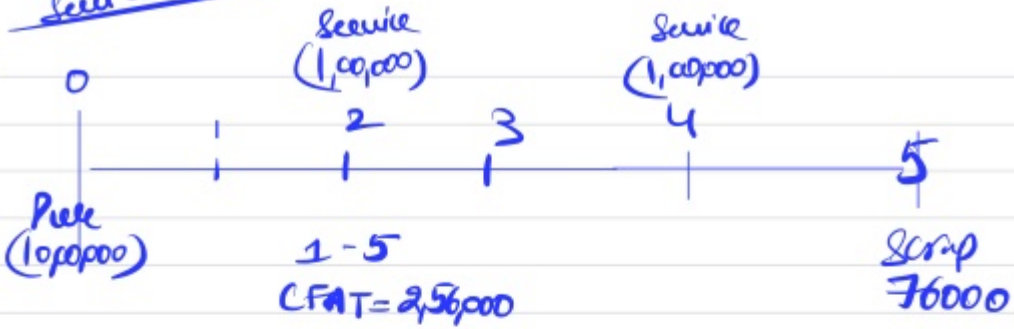
Statement of NPV

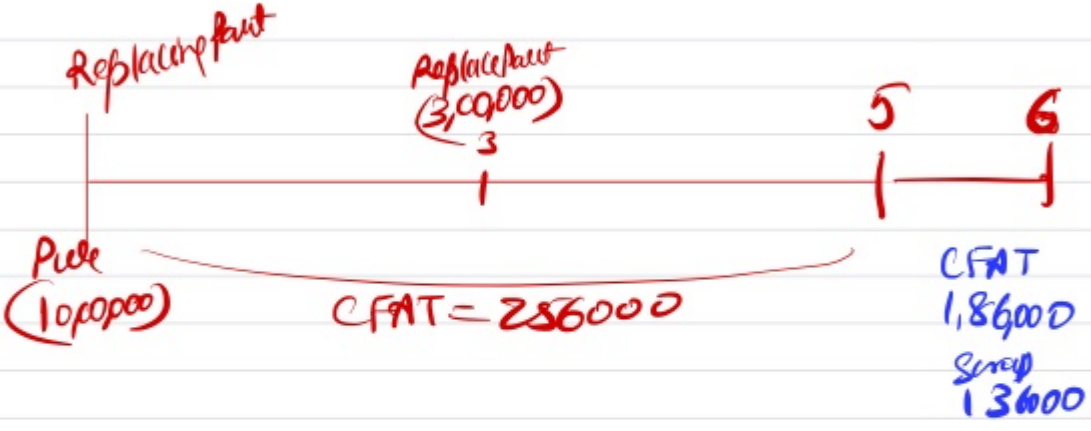
Particulars	Year	PV factor	New Machine		Leland Hand	
			Amt	PV	Amt	PV
Purchase of Machine	0	1	1,59000	1,59000	80,000	80,000
Tax Saving on Dep	1	0.892	11250	(10,035)	6000	( )
	2	0.797	8437	( )	4500	( )
	3	0.711	6328	( )	3375	( )
	4	0.635	4746	( )	2531	( )
	5	0.567	3560	( )	1898	( )
Sale of Machine	5	0.567			18985	(10765)
Purchase of machine	5	0.567			60,000	34020
Tax Saving on Dep	6	0.506	2670	( )	4500	( )
	7	0.452	2002	( )	3375	( )
	8	0.403	1502	( )	2531	( )
	9	0.36	1126	( )	1898	( )
	10	0.322	845	( )	1424	( )
Sale of Asset	10	0.322	8447	( )	14239	( )
			PVCo	1,17,452		78686

Advice: Buy Leland hand Machine

Servicing Part

Sol(6)





Statement of NPV

Particulars	yr	PVf @ 12%	Servicing option Amt	Servicing option PV	Replacement option Amt	Replacement option PV
Purchase Machine	0	1	10,00,000	(10,00,000)	10,00,000	(10,00,000)
Annual Inflow						
CFAT	1		256000		256000	
(CFAT - Service cost)	2		1,56000		256000	
(CFAT - Replacement)	3		256000		(44000)	
(CFAT - Service cost)	4		1,56000		256000	
CFAT	5		256000		256000	
CFAT	6		X		186000	
Scrap Sale	5		76000		-	-
	6		-	-	136000	
			NPV	-177344.	NPV	-127611

Advice: Machine Shouldn't be purchased at all as both options have negative NPV.

Alternative Presentation:

Particulars	yr	PVf @ 12%	Service option Amt	Service option PV	Replacement option Amt	Replacement option PV
Purchase of Machine	0	1	10,00000	(10,00000)	10,00000	(10,00000)
Service Machine	2		100000		-	-
Service Machine	4		100000		-	-
Replacement cost	3		-	-	300000	
CFAT	1-5		256000		256000	
CFAT	6		-	-	186000	
Scrap Sale	5		76000		-	-
	6		-	-	136000	
			NPV	-177344	NPV	-127611

Sd 61 (ii) If Supplier offers 9000 discount

	Service option	Replacement option
NPV originally	−17734	−127611
	+9000	+9000
New New	−87344	−37611

Decision → Machine should not be purchased.

Sol 62 Let minimum savings of labour required to accept the proposal be ₹x.

Particulars	Yr	P.V factor	Amt	PV
outflows	0	1	80000	80000
			PVCo (A)	80000
Inflows				
Saving in Material	1-7	4.564	8000	36512
Saving in labour	1-7	4.564	x	4.564x
			PVCI (B)	36512 + 4.564x

We can accept Proposal at minimum NPV = 0.

NPV = 0, PVCI = PV Co

$8000 = 36512 + 4.564x$

$x = 9528$

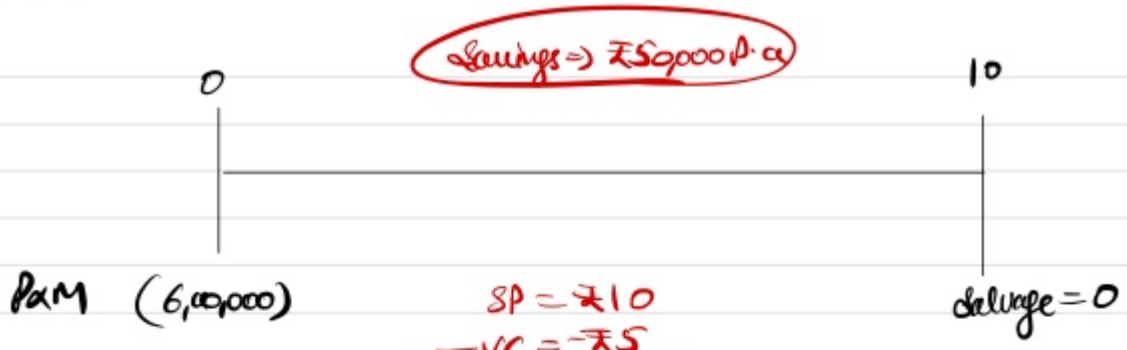
original labour saving = ₹14000
− Minimum savings of labour = −₹9528
Reduction of labour saving = ₹4472

% Reduction in labour saving $= \frac{4472}{14000} \times 100$

$= 31.94\%$

If labour saving is reduced by over 31.94%, then this Project will become non-viable.

Sol 63



SP = ₹10
− VC = ₹5
Cont = ₹5
× Gallon × 50,000
Cont = 250000
− FC = − 30000
− Advt − 20000
PBT = 200000
− DP

Lo(67)

Statement of NPV

Project	PVCO	PVCI	NPV
1 only	2,00,000	2,90,000	90,000
2 only	1,15,000	1,85,000	70,000
3 only	2,70,000	4,00,000	1,30,000
1 & 2	(200 + 115) 3,15,000	(290 + 185) 4,75,000	1,60,000
1 & 3	(200 / 270) = ~~4,70,000~~ 4,40,000	(290 / 400) → 6,90,000	2,50,000
2 & 3	(115 / 270) 3,85,000	(185 / 400) = ~~5,85,000~~ 6,20,000	2,35,000
1 & 2 & 3	(200 / 115 / 270) → 4,40,000 + 1,15,000 = 5,55,000; Plant & Equip. + 1,25,000 = 6,80,000	290 → 290000; (185 / 400) → 6,20,000 = 6,10,000	2,30,000

Advice: Select Project 1 & 3 together as they provide highest NPV Combination.

Q68

WON 1

	1st year	
X	Dep = 10%	Next 14 years, Dep = 6% p.a
Y	Dep = 40%	Next 9 years Dep 6% p.a

Y on Rent
1st year Rent ₹24000
2-5th year Rent ₹25,000
6th to 10th year Rent ₹70,000

WON 2 Calculation of Residual value

		Dep 1st year	Dep 2nd to 15th year	= Residual Value
X	⇒ ₹15,00,000 −	10% × 15L −	6% × 15L × 14 yrs	= 90,000
		Dep 1st year	Dep 2nd to 10th yr	
Y	⇒ ₹10,00,000 −	40% × 10L −	10L × 6% × 9 yrs	= 60,000

(a) If we have to use Machine for 20 years

Buy Machine X

Particulars	year	PV factor	Amt	PV
Purchase of Machine	0	1	1500000	15,00,000
Maintenance cost	1-5	3.605	50,000	1,80,250
	6-10	2.046	70,000	1,43,220
	11-15	1.161	98000	1,13,778
Scrap/Realisable Asset	15	0.183	90,000	(16470)
			Outflow for 15 years	19,20,778
		÷ Cumulative PV factor for 15 yrs		÷ 6.812

Equivalent Annual PVCO = ₹28197 0

Buy Machine Y.

Particulaers	Year	PV factor	Amount	PV
Purchase of Machine	0	1	10,00,000	10,00,000
Maintenance Cost	1-5	3.605	79000	2,52,350
	6-10	2.046	1,15,000	2,35,290
Scrap Sale of Machine	10	0.322	(6000)	(1932)
			outflows for 10 years	14,68,320
÷ Cummulative PV factor for 10 years				÷ 5.651

Equivalent Annual PVCo Y = ₹259834

Hire Machine Y

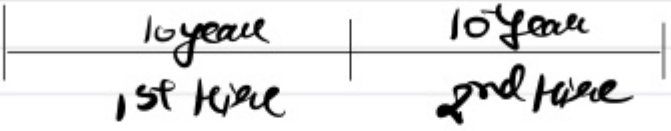
Particulaers	year	PV factor	Amt	PV
Hire charges Paid	0	1	2,24,000	224000
(Paid in beginning of year)	1-4	3.038	2,25,000	6,83,550
	5-9	2.291	2,79,000	6,18,570
			Cashoutflows in 10 year =	15,26,120
÷ Cummulative PV factor for 10 years				÷ 5.651

Equivalent Annual PVCo for Hire Y = ₹270062

Advice: If we want to use machines for 10 years, we should opt for **Buy Machine Y** because it has **least Equivalent Annual PVCo.**

Note: Agaar hum 20 years ke liye Machine use kar rahe hai, toh obviously

'Hire of Machine Y'



Yani hum Machine ko two times hire karenge, and done baar full life use karenge, So, no Penalty arises.

Q68 (ii) If we use Machines for 5 years

Calculation of Residual Value

Residual value

Machine X = 15,00,000 − 10%×15L − 6%×15L×4 years = 9,90,000
(1st year dep) (2nd to 5 year)

Machine Y = 10,00,000 − 40%×10L − 6%×10L×4 yrs = 3,60,000
(1st year dep) (2nd to 5 yrs)

Penalty on sold Machine Y ⇒ 2,20,000 − 5 years × 22000 = ₹1,10,000

* Buy Machine X

Particulars	year	P.V. factor	Amt	PV
Purchase of machine	0	1	15,00,000	15,00,000
Maintenance	1-5	3.605	50,000	1,80,250
Scrap sale	5	0.567	9,90,000	(56130)
PVCO. = Cash outflow for 5 years =				11,18,920

* Buy Machine Y.

Purchase of machine	0	1	10,00,000	10,00,000
Maintenance	1-5	3.605	79000	2,84,350
Scrap sale of asset	5	0.567	(3,60,000)	(204120)
PVCO for 5 years =				10,48,230

★ Hire Machine Y.

Particulars	Year	PV factor	Amt	PV
Hire charges	0	1	224000	224000
	1-4	3.038	225000	683550
Penalty paid	5	0.567	1,10,000	62370
		PVCo for 5 years		9,69,920

Advice: Machine Y on Hire should be accepted, because it has least PV Co for 5 years.

Sol 71

Statement of ranking

Project	PVCO (B)	PI	PVCI (A)	NPV (A − B)	Rank (on PI)
1	3,00,000	1.22	3,66,000	66,000	I
2	1,50,000	0.95	1,42,500	−7500	—
3	3,50,000	1.20	4,20,000	70,000	II
4	4,50,000	1.18	5,31,000	81,000	III
5	2,00,000	1.20	2,40,000	40,000	II
6	4,00,000	1.05	4,20,000	20,000	IV

(ii) If Projects are divisible

Rank	Project		PVCO	NPV
I	1		3,00,000	66,000
II	3		3,50,000	70,000
II	5		2,00,000	40,000
			8,50,000	
III	4	4.64	1,50,000	$\left(\frac{81000 \times 1.5}{4.5}\right)$ = 27,000
			10,00,000	2,37,000

(i) If Projects are not divisible

Combination ①

Project	PVCO	NPV
3	3,50,000	70,000
4	4,50,000	81,000
5	2,00,000	40,000
	10,00,000	1,91,000

Combination ②

Project	PVCO	NPV
1	3,00,000	66,000
3	3,50,000	70,000
5	2,00,000	40,000
	8,50,000	1,76,000

Rejected

Combination ③

Project	PVCO	NPV
3	3,50,000	70,000
5	2,00,000	40,000
6	4,00,000	20,000
	9,50,000	1,30,000

Rejected

Select Combination ①,
Invest in Project 3, 4 & 5.

Sol 72 Available funds to invest = ₹30,00,000.

Statement of Ranking

Project	PVCo (A)	PVCI (B)	NPV (B − A)	PI = PVCI / PVCO	Rank
1	8,00,000	10,00,000	2,00,000	1.25	(4)
2	15,00,000	19,00,000	4,00,000	1.27	(3)
3	7,00,000	11,40,000	4,40,000	1.63	(1)
4	13,00,000	20,00,000	7,00,000	1.54	(2)

Type (i) If Projects are divisible.

Rank	Project	Amt Invested	NPV
1	3	7,00,000	4,40,000
2	4	13,00,000	7,00,000
		10,00,000 Balance	
3	2	~~15~~ 10,00,000	(4,00,000 × 10/15) 2,66,667
		Total Invested = ₹30,00,000	NPV ₹14,06,667

Type (2) If Projects are not divisible.

Combination (1)

Project	PVCo	NPV
3	7,00,000	4,40,000
4	13,00,000	7,00,000
1	8,00,000	2,00,000
	28,00,000	13,40,000
RF asset	2,00,000	(7313)
	30,00,000	13,32,687

Combination (2)

Project	PVCo	NPV
1	8,00,000	2,00,000
2	15,00,000	4,00,000
3	7,00,000	4,40,000
	30,00,000	10,40,000

Rejected

Combination (3)

Project	PVCo	NPV
2	15,00,000	4,00,000
4	13,00,000	7,00,000
	28,00,000	11,00,000

Rejected

If Projects are indivisible, then Optimum Total NPV of ₹13,32,687

con① unutilized amount = ₹2,00,000

If we invest this amount at Risk free rate.

Amount received at end of 5 years.

$2,00,000 (1+10\%)^5 = ₹2,00,000 \times 1.611$

$= ₹3,22,200$

Statement of NPV

Particulars	yr	PV factor (12%)	Amt	PV
outflow (in RF asset)	0	1	2,00,000	(2,00,000)
Inflow (at end of 5th year)	5	0.567	3,22,200	182687
			NPV	(17313)

So, we are earning Negative NPV on Risk free asset.

Sol 74 option ① Travel, no video conferencing

Cost of Travel = Locations (No of) × Persons (No of) × Trips × Cost (Travel)

~~8~~ 7 × 2 × 2 × 27000 = ₹ 756000

option ② video conferencing, own equipment

Annual dep = $\left(\frac{825000 - 0}{5 \text{ year (Dep)}}\right)$ × 8 locations = 1320000

Annual Transmission cost = (48 hrs × 8 locations × 300 days) = 115200

Total Cost with own video conferencing = ₹ 1435200

option ③ video conferencing on rental basis

Rental cost = 48 hrs × 8 locations × (1500 + 400) = ₹ 729600

Advice: Rental cost of video conferencing is cheapest, so it should be accepted.

Q(15) 0 — 8 year

(18L) Maintenance cost = 2L Scrap = 4L

	year	PV factor	Amt	PV
Initial cost	0	1	18,00,000	18,00,000
Annual Maintenance	1-8	4.4873	2,00,000	8,97,460
less Scrap Sale	8	0.3269	4,00,000	(1,30,760)
PV Co				25,66,700
÷ Cummulative PV factor for 8 years				÷ 4.4873

Equivalent Annual PV (cost) of New = ₹5,71,992

option (I) If we Replace Today (Immediately)

Maintenance cost on old Machine = 0
Sale of old Machine = 8,00,000
Equivalent Annual Cost of New Machine = (5,71,992)

Net Amount = ₹2,28,008

option (II) If we Replace at end of 1st Year.

Particulars	yr	PV factor	Amt	PV
Maintenance cost	1	0.8696	(2,00,000)	(1,73,920)
Sale of old	1	0.8696	5,00,000	4,34,800
EAC of New	1	0.8696	(5,71,992)	(4,97,404)
			Net PV	(2,36,524)

option (III) If we Replace at end of 2nd year.

Maintenance cost	1	0.8696	2,00,000	(173920)
	2	0.7561	4,00,000	(302440)
Sale of old	2	0.7561	3,00,000	226830
EA Cost new	2	0.7561	571992	(432483)
			Net PV	(682013)

option (IV) If we replace at end of 3rd year.

Maintenance cost	1	0.8696	2,00,000	(173920)
	2	0.7561	4,00,000	(302440)
	3	0.6575	6,00,000	(394500)
Sale of old	3	0.1575	2,00,000	+131500
EA Cost new	3	0.6575	571992	(376085)
			Net PV	(11,15,445)

option (V) If we Replace at end of 4th year

Particulars				
maintenance	1	0.8696	2,00,000	(173920)
	2	0.7561	4,00,000	(302440)
	3	0.6575	6,00,000	(394500)
	4	0.5718	8,00,000	(457440)
Sale of old	4	0.5718	0	0
EA Cost new	4	0.5718	571992	(327065)
			Net PV	(16,55,365)

Advice: Replace immediately.

Solution 1:

Particulars	Amount (₹)
Profit Before Tax	3,00,000
Less: Tax @ 50%	1,50,000
Profit after tax	1,50,000
Add: Depreciation written off	2,50,000
Total cash inflow	4,00,000

Payback period = $\frac{₹\ 20,00,000}{₹\ 4,00,000}$ = 5 years

Solution 3:

Payback Reciprocal = $\frac{₹4,000 \times 100}{₹20,000}$ = 20%

Solution 4:

(a) If Initial Investment is considered then, $\frac{Total\ Profit/No.of\ years}{Average\ Investment/Intial\ Investment} \times 100$

$= \frac{92,000}{10,00,000} \times 100 = 9.2\%$

(b) If Average Investment is considered, then, $\frac{92,000}{Average\ Investment} \times 100$

$= \frac{92,000}{5,40,000} \times 100 = 17\%$

Working Notes:

Average Investment = Salvage value + ½ (Initial investment – Salvage value)

= ₹ 80,000 + ½ (₹ 10,00,000 – ₹ 80,000)

= ₹ 80,000 + ₹ 4,60,000 = ₹ 5,40,000

Solution 5:

The ARR can be computed by following methods as follows:

(a) Version 1: Annual Basis

ARR = $\frac{Profit\ after\ Depreciation}{Investment\ in\ the\ begining\ of\ the\ year}$

Year	
1	$\frac{80,000}{3,00,000}$ = 26.67%
2	$\frac{80,000}{2,30,000}$ = 34.78%
3	$\frac{80,000}{1,60,000}$ = 50%

Average ARR = $\frac{26.67\% + 34.78\% + 50.00\%}{3}$ = 37.15%

(b) Version 2: Total investment Basis

ARR = $\frac{Average\ Annual\ Profit}{Investment\ in\ the\ begining}$ = $\frac{(80,000 + 80,000 + 80,000)/3}{3,00,000}$ x 100 = 26.67%

(c) Version 3: Average Investment Basis

ARR = $\frac{Average\ Annual\ Profit}{Average\ Investment}$ x 100

Average Investment = (₹3,00,000 + ₹ 90,000)/2 = ₹1,95,000

Or, ½(Initial Investment – Salvage Value) + Salvage Value

= ½(₹3,00,000 –₹90,000) + ₹90,000 = ₹ 1,95,000

= $\frac{80,000}{1,95,000}$ x 100 = 41.03%

Further, it is important to note that project may also require additional working capital during its life in addition to initial working capital. In such situation formula for the calculation of average investment shall be modified as follows:

½(Initial Investment – Salvage Value) + Salvage Value+ Additional Working Capital

Continuing above example, suppose a sum of ₹45,000 is required as additional working capital during the project life then average investment shall be:
= ½ (₹3,00,000 – ₹90,000) + ₹90,000 + ₹45,000 = ₹2,40,000 and
ARR = $\frac{80,000}{2,40,000}$ x 100 = 33.33%

Some organizations prefer the initial investment because it is objectively determined and is not influenced by either the choice of the depreciation method or the estimation of the salvage value. Either of these amounts is used in practice but it is important that the same method be used for all investments under consideration.

Solution 7:

Calculation of Net Present Value(In ₹)

Period	Present Value Factor	Project A	Project B	Project C	Project D
1	0.893	44,650	35,720	66,975	66,975
2	0.797	39,850	39,850	59,775	59,775
3	0.712	35,600	49,840	42,720	42,720
4	0.636	31,800	47,700	50,880	25,440
5	0.567	28,350	42,525	56,700	11,340
Present value of cash inflows		1,80,250	2,15,635	2,77,050	2,06,250
Less: Initial Investment		2,00,000	1,90,000	2,50,000	2,10,000
Net present value		(19,750)	25,635	27,050	(3,750)

Solution 8:

Calculation of Net Present Value

Year	Net Cash Flow (₹)	P.V. Factor	Present Value (₹)
0	(1,00,000)	1.000	(1,00,000)
1	6,500	0.909	5,909
2	26,500	0.826	21,889
3	41,500	0.751	31,167
4	41,500	0.683	28,345
5	71,500	0.621	44,402
		Net Present Value =	31,712

Working Notes:
Calculation of Net Flows
Contribution = (3.00 – 1.75) × 50,000 = ₹ 62,500
Fixed costs = 40,000 – (1,25,000 – 30,000)/5 = ₹ 21,000

Year	Capital (₹)	Contribution (₹)	Fixed costs (₹)	Adverts (₹)	Net cash flow (₹)
0	(1,00,000)				(1,00,000)
1	(25,000)	62,500	(21,000)	(10,000)	6,500
2		62,500	(21,000)	(15,000)	26,500
3		62,500	(21,000)		41,500
4		62,500	(21,000)		41,500
5	30,000	62,500	(21,000)		71,500

Solution 9:

The desirability factors for the three projects would be as follows:

1. $\frac{₹6,50,000}{₹5,50,000}$ = 1.18
2. $\frac{₹95,000}{₹75,000}$ =1.27
3. $\frac{₹1,00,30,000}{₹1,00,20,000}$ = 1.001

Solution 10:

Determination of Cash inflows

Elements	(₹)

Sales Revenue	45,00,000
Less: Operating Cost	14,00,000
	31,00,000
Less: Depreciation (90,00,000 – 10,00,000)/5	16,00,000
Net Income	15,00,000
Tax @ 40%	6,00,000
Earnings after Tax (EAT)	9,00,000
Add: Depreciation	16,00,000
Cash inflow after tax per annum	25,00,000
Less: Loss of Commission Income	6,60,000
Net Cash inflow after tax per annum	**18,40,000**
In 5th Year:	
New Cash inflow after tax	18,40,000
Add: Salvage Value of Machine	10,00,000
Net Cash inflow in year 5	**28,40,000**

Calculation of Net Present Value (NPV)

Year	CFAT	PV Factor @10%	Present Value of Cash inflows
1 to 4	18,40,000	3.169	58,30,960
5	28,40,000	0.62	17,60,800
			75,91,760
Less: Cash Outflows			90,00,000
NPV			(14,08,240)

Profitability Index= $\frac{Sum\ of\ discounted\ cash\ inflows}{Present\ value\ of\ Cash\ outflows}$= $\frac{75,91,760,}{90,00,000}$=0.844

Advise: Since the net present value is negative and profitability index is also less than 1, therefore, the hospital should not purchase the MRI machine.

Solution 11:

Calculation of IRR

The 'Factor' must be found out, 'the factor reflects the same relationship of investment and cash inflows as in case of payback calculations':

F = $\frac{I}{C}$

Where, F = Factor to be located

I = Original Investment

C = Average cash inflow per year

For the project,

Factor = $\frac{₹\ 1,36,000}{₹\ 36,000}$= 3.78

The factor thus calculated will be located in present value of Re. 1 received annually for N year's table corresponding to the estimated useful of the asset. This would give the expected rate of return to be applied for discounting the cash inflows.

In case of the project, the rate comes to 10%.

Year	Cash Inflows (₹)	Discounting Factor at 10%	Present Value (₹)
1	30,000	0.909	27,270
2	40,000	0.826	33,040
3	60,000	0.751	45,060
4	30,000	0.683	20,490
5	20,000	0.621	12,420
		Total Present Value	1,38,280

The present value at 10% comes to ₹ 1,38,280, which is more than the initial investment. Therefore, a higher discount rate is suggested, say, 12%.

Year	Cash Inflows(₹)	Discounting Factor at 12%	Present Value (₹)

1	30,000	0.893	26,790
2	40,000	0.797	31,880
3	60,000	0.712	42,720
4	30,000	0.636	19,080
5	20,000	0.567	11,340
		Total Present Value	1,31,810

IRR = $[10 + (\frac{₹1,38,280 - ₹1,36,000}{₹1,38,280 - ₹1,31,810}) \times 2$

= $10 + (\frac{₹\ 2280}{₹\ 6470}) \times 2$ = 10.7%

Solution 12:

Computation of cash inflow per annum

Particulars	₹
Net operating income per annum	68,000
Less: Tax @ 45%	30,600
Profit after tax	37,400
Add: Depreciation (₹ 3,60, 000/5 years)	72,000
Cash inflow	1,09,400

The IRR of the investment can be found as follows:

NPV = -₹ 3,60,000 + ₹ 1,09,400 ($PVAF_5$,r) = 0

Or PVA F_5r (Cumulative factor) = $\frac{₹3,60,000}{₹1,09,400}$ = 3.29

Computation of internal Rate of Return

Discounting Rate	15%	16%
Cumulative factor	3.35	3.27
Total NPV (₹)	3,66,490 (₹ 109,400 × 3.35)	3,57,738 (₹ 1,09,400 × 3.27)
Internal outlay (₹)	3,60,000	3,60,000
Surplus (Deficit)(₹)	6,490	(2,262)

IRR = 15 + $(\frac{6490}{6490+2262})$ = 15 + 0.74= 15.74%.

Solution 13:

1. **Conversion of Cash Flows into Terminal Value**

Year	CFAT	Reinvestment Factor at 8%	Terminal Value at 8%
1	30,000	$(1 + 0.08)^4 = 1.3605$	40,815
2	40,000	$(1 + 0.08)^3 = 1.2597$	50,388
3	60,000	$(1 + 0.08)^2 = 1.1664$	69,984
4	30,000	$(1 + 0.08)^1 = 1.0800$	32,400
5	20,000	$(1 + 0.08)^0 = 1.0000$	20,000
		Total	2,13,587

2. **Computation of MIRR**

$P (1 + R)^n = A$,

Where P = Initial Investment = ₹ 1,36,000, A = Terminal Value of Inflows = ₹ 2,13,587

N = Number of years of Project Life = 5, R = MIRR (to be calculated)

$\therefore 1,36,000 (1 + R)^5 = 2,13,587.$

Hence, $(1 + R)^5 = \frac{2,13,587}{1,36,000} = 1.5705$

From the FV Tables, $(1 + R) = 1.5705^{1/5} = 1.09448.$

So, R = 0.09448. Hence, MIRR = 9.448%

Solution 16:

1. Computation of ARR

Average Rate of Return = $\frac{Average\ Project\ after\ Tax}{Average\ capital\ employed}$

= $\frac{(40,000+30,000+20,000+10,000+10,000)/5}{(2,50,000+40,000)/2}$

$= \frac{22,000}{1,45,000} \times 100 = 15.17\%$

2. Computation of payback period

Depreciation p.a. $= \frac{₹2,50,000 - ₹40,000}{5\ years} =$ ₹ 42,000 per annum.

Year	PAT	Depreciation	CFAT = PAT + Depreciation	Cumulative CFAT
1	₹ 40,000	₹ 42,000	₹ 82,000	₹ 82,000
2	₹ 30,000	₹ 42,000	₹ 72,000	₹ 1,54,000
3	₹ 20,000	₹ 42,000	₹ 62,000	₹ 2,16,000
4	₹ 10,000	₹ 42,000	₹ 52,000	₹ 2,68,000
5	₹ 10,000	₹ 42,000	₹ 52,000	₹ 3,20,000

Simple payback period = $3 + \frac{₹34,000}{₹52,000}$ = 3.65 Years.

Solution 18:

(a) & (b) **Calculation of Computation of NPV** (In ₹)

Particulars	Years	Amount	PV Factor @ 15%	PV	PV Factor @ 10%	PV
Outflows						
Initial Investment	0	7,00,000	1	7,00,000	1	7,00,000
Further Investment	1	10,00,000	0.869	8,69,000	0.909	9,09,000
PVCO (A)				15,69,000		16,09,000
Inflows						
CFAT	2	2,50,000	0.756	1,89,000	0.826	2,06,500
	3	3,00,000	0.657	1,97,100	0.751	2,25,300
	4	3,50,000	0.572	2,00,200	0.683	2,39,050
	5 - 10	4,00,000	2.164	8,65,600	2.975	11,90,000
PVCI (B)				14,51,900		18,60,850
NPV (A) – (B)				(1,17,100)		2,51,850

Advice: When PV factor is @ 15% than NPV is negative, Proposal cannot be accepted. When PV factor is @ 10% then NPV is positive, Proposal should be accepted.

(c) Internal Rate of Return (IRR) = Lower Rate + $\frac{Lower\ Rate\ NPV}{NPV\ at\ lower\ rate - NPV\ at\ higher\ rate}$ × Difference in Rate of NPV

$= 10 + \frac{2,51,850}{2,51,850+1,17,100} \times 5 = 13.41\%$

(d) Simply Payback period = 6 years

-₹ 7,00,000 – ₹ 10,00,000 + ₹ 2,50,000 + ₹3,00,000 + ₹ 3,50,000 + ₹ 4,00,000 + ₹ 4,00,000 = 0

Solution 19:

(i) Calculation of Pay-back Period

Cash Outlay of the Project = ₹. 1,60,00,000

Total Cash Inflow for the first five years = ₹. 1,40,00,000 .

Balance of cash outlay left to be paid back in the 6th year ₹. 20,00,000 .

Cash inflow for 6th year = ₹. 32,00,000

So the payback period is between 5th and 6th years, i.e.,

5 years + $\frac{₹.\ 20,00,000}{₹.\ 32,00,000}$ 5.625 years or 5 years 7.5 months

(ii) Calculation of Net Present Value (NPV) @10% discount rate:

Year	Net Cash Inflow (₹.)	Present Value Factor at 10% Discount Rate	Present Value (₹.)
	(a)	(b)	(c) = (a) x(b)
1	28,00,000	0.909	25,45,200
2	28,00,000	0.826	23,12,800
3	28,00,000	0.751	21,02,800
4	28,00,000	0.683	19,12,400

5	28,00,000	0.621	17,38,800
6	32,00,000	0.564	18,04,800
7	40,00,000	0.513	20,52,000
8	60,00,000	0.467	28,02,000
9	40,00,000	0.424	16,96,000
10	16,00,000	0.386	6,17,600
			1,95,84,400

Net Present Value (NPV) = Present Value of Cash Inflows - Cash Outflow
= ₹. 1,95,84,400 - ₹.1,60,00,000 = 35,84,400

(iii) Calculation of Profitability Index @ 10% discount rate:

Profitability Index = $\frac{Present\ Value\ of\ Cash\ inflows}{Cost\ of\ the\ Investment}$

= $\frac{₹.\ 1,95,84,400}{₹.\ 1,60,00,000}$ = 1.224

(iv) Calculation of Internal Rate of Return:

Net present value @ 10% discount factor has already been calculated in (ii) above, we will calculate Net present value @15% discount factor.

Year	Net Cash Inflow (₹.)	Present Value Factor at 15% Discount Rate	Present Value (₹.)
	(a)	(b)	(c) = (a) x(b)
1	28,00,000	0.870	24,36,000
2	28,00,000	0.756	21,16,800
3	28,00,000	0.658	18,42,400
4	28,00,000	0.572	16,01,600
5	28,00,000	0.497	13,91,600
6	32,00,000	0.432	13,82,400
7	40,00,000	0.376	15,04,000
8	60,00,000	0.327	19,62,000
9	40,00,000	0.284	11,36,000
10	16,00,000	0.247	3,95,200
			1,57,68,000

Net Present Value at 15% = ₹.1,57,68,000 – ₹.1,60,00,000 = ₹. -2,32,000
As the net present value @ 15% discount rate is negative, hence internal rate of return falls in between 10% and 15%. The correct internal rate of return can be calculated as follows:

IRR = L + [(NPV_L) / $NPV_L - NPV_H$] (H – L)

= 10% + $\frac{₹.\ 35,84,400}{₹.\ 35,84,400-(-₹.\ 2,32,000)}$ (15% - 10%)

= 10% + $\frac{₹.\ 35,84,400}{₹.\ 38,16,400}$ x 5% = 14.7%

Solution 20:

(a)

(i) Payback Period

Project Cumulative Cash Outflows (In ₹)

Years	A	B	C	D
1	10,000	7,500	2,000	10,000
2	-	15,000	6,000	13,000
3	-	-	18,000	16,000

Payback Period (In ₹)

	A	B	C	D
Cash Outflows	(10,000)	(10,000)	(10,000)	(10,000)
Payback Period	1 yr	1 yr + $\frac{2,500}{7,500}$ = 1.33 yrs	2 yrs + $\frac{4,000}{12,000}$ = 2.33 yrs	1 yr

(ii) ARR = $\frac{(CFAT-Depreciation)\times 1/No.\ of\ years}{Average\ Investment}$

Project A: $\frac{(10,000-10,000)1/1}{(10,000)1/2}$ = 0

Project B: $\frac{(15,000-10,000)1/2}{(10,000)1/2}$ = 2,500/5,000 = 50%

Project C: $\frac{(18,000-10,000)1/3}{(10,000)1/2}$ = 2,667/5,000 = 53%

Project D: $\frac{(16,000-10,000)1/3}{(10,000)1/2}$ = 2,000/5,000 = 40%

Note: This net cash proceed includes recovery of investment also. Therefore, net cash earnings are found by deducting initial investment.

(iii) IRR

Project A: The net cash proceeds in year 1 are just equal to investment. Therefore, r = 0%

Project B: This project produces an annuity of ₹ 7,500 for two years.

Therefore, the required PVAF is: 10,000/7,500 = 1.33. This factor is found under 32% column. ∴ r = 32%.

Project C: Since cash flows are uneven, the trial and error method will be followed.

Using 20% rate of discount the NPV is + ₹ 1,389. At 30% rate of discount, the NPV is (₹ 633).The true rate of return should be less than 30%. At 27% rate of discount it is found that the NPV is –₹ 86 and at 26% + ₹ 105. Through interpolation, we find r = 6.5%

Project D: In this case also by using the trial and error method, it is found that at 37.6% rate of discount NPV become almost zero. Therefore, r = 37.6%.

(iv) NPV

Project A:

At 10% - 10,000 + 10,000 × 0.909 = (910)

At 30% - 10,000 + 10,000 × 0.769 = (2,310)

Project B:

At 10% - 10,000 + 7,500(0.909 + 0.826) = +3,013

At 30% - 10,000 + 7,500(0.769 + 0.592) = +208

Project C:

At 10% - 10,000 + 2,000 × 0.909 + 4,000 × 0.826 + 12,000 × 0.751 = +4,134

At 30% - 10,000 + 2,000 × 0.769 + 4,000 × 0.592 + 12,000 × 0.455 = (633)

Project D:

At 10% - 10,000 + 10,000 × 0.909 + 3,000 × (0.826 + 0.751) = +3821

At 30% - 10,000 + 10,000 × 0.769 + 3,000 × (0.4555) = +831

The projects are ranked as follows according to the various methods:

Ranks					
Projects	**PBP**	**ARR**	**IRR**	**NPV (10%)**	**NPV (30%)**
A	1	4	4	4	4
B	2	2	2	3	2
C	3	1	3	1	3
D	1	3	1	2	1

(b) Payback and ARR theoretically unsound method for choosing between the investment projects. Between the two time-adjusted (DCF) investment criteria, NPV and IRR, NPV gives consistent results. If the projects are independent (and there is no capital rationing), either IRR or NPV can be used since the same set of projects will be accepted by any of the methods. In the present case, except projects A all the three projects should be accepted if the discount rate is 10%. Only projects B and D should be undertaken if the discount rate is 30%.

If it is assumed that the projects are mutually exclusive, then under the assumption of 30% discount rate, the choice is between B and D (A and C are unprofitable). Both criteria IRR and NPV give the same results, D is the best. Under the assumption of 10% discount rate, ranking according to IRR and NPV conflict (except for project A). If the IRR rule is followed, project D should be accepted. But the NPV rule tells that project C is the best. The NPV rule generally gives consistent results in conformity with the wealth maximization principle. Therefore, project C should be accepted following the NPV rule.

Solution 22:

Particulars	**₹**
Additional Income (Saving in Materials Waste)	50,000
Less: Additional Depreciation on new Machine = $(\frac{₹2,00,000}{10\ years})$	20,000
Additional Profit before Tax	30,000
Less: Tax thereon at 50%	15,000

Profit After Tax Add: Depreciation	15,000 20,000
Cash Flow After Taxes	35,000
Annuity Factor for 10 years at 10%	6.1446
Discounted Cash Inflows (PVCI) (₹ 35,000 × 6.1446) Less: Initial Investment (PVCO)	2,15,061 2,00,000
Net Present Value (PVCI – PVCO)	15,061
PI = $\frac{PVCI}{PVCO}$=($\frac{₹2,15,061}{₹2,00,000}$)	1.075

Decision: Since NPV > 0 and PI > 1, the Company may purchase the New Machinery.

IMPORTANT NOTE: In case of uniform CFAT, use Annuity Factors. In case of differential CFAT, use PV Factors. NPV and PI generally give the same accept reject decision.

Solution 23:

Project Outflow ₹ 2,00,000

Year	1 (₹)	2 (₹)	3(₹)	4 (₹)	5(₹)	
Profit after depreciation but before tax	85,000	1,00,000	80,000	80,000	40,000	
Less: Tax (30%)	(25,500)	(30,000)	(24,000)	(24,000)	(12,000)	
PAT	59,500	70,000	56,000	56,000	28,000	Average=₹ 53,900
Add: Depreciation	40,000	40,000	40,000	40,000	40,000	
Net Cash Inflow	99,500	1,10,000	96,000	96,000	68,000	Average=₹ 93,900

(i) Calculation of payback period 1.91 years

(ii) Calculation of ARR

Average Investment = $\frac{2,00,000+0}{2}$ = ₹ 1,00,000

ARR= Average of profit after tax/average investment =$\frac{₹53,900}{₹1,00,000}$= 53.90%

(iii) Calculation of net present value 10%

Net Cash Inflow	99,500.00	1,10,000.00	96,000.00	96,000.00	68,000.00	
	0.909	0.826	0.751	0.683	0.621	
Present value	90,445.50	90,860.00	72,096.00	65,568.00	42,228.00	3,61,197.50

Net present value = ₹ 3,61,197.50 – ₹ 2,00,000= ₹ 1,61,197.50

Net present value index= Rs 1,61,197.50/₹ 2,00,000 =0.81

(iv) Calculation of IRR = $\frac{Present\ value\ factor - Initial\ investment}{Average\ annual\ cash\ inflow}$ = $\frac{2,00,000}{93,900}$= 2.13

It lies in between 38% and 40%

Net Cash inflows	99,500.00	1,10,000	96,000.00	96,000.00	68,000.00	
Present value factor @38%	0.725	0.525	0.381	0.276	0.200	
Present value @ 38% (P1)	72,137.50	57,750.00	36,576.00	26,496.00	13,600.00	Total = 2,06,559.50
Net Cash inflows	99,500.00	1,10,000.00	96,000.00	96,000.00	68,000.00	
Present value factor @ 40%	0.714	0.51	0.364	0.260	0.186	
Present value @ 40% (P2)	71,043	56,100	34,944	24,960	12,648	Total = 1,99,695

IRR is calculated by Interpolation:

IRR= 38+$\frac{6,559.50}{(2,06,559.50-1,99,695)}$× 2% = 39.91%

Solution 24:

(i) Projects Cumulative Cash Inflows

Years	A	B	C	D
1	6,000	2,500	1,500	0
2	8,000	5,000	4,000	0
3	10,000	10,000	4,500	3,000
4	22,000	17,500	9,500	9,000

Initial Cash Outflows

	A	B	C	D
0	(10,000)	(10,000)	(3,500)	(3,000)
Pay Back Period	3 Years	3 Years	1 Yr + $\frac{2,000}{2,500}$ = 1.8 Years	3 Years

(i) If standard payback is 2 years, Project C is the only acceptable project. But if standard payback period is 3 years, all the four projects are acceptable. However, as the projects are mutually exclusive, only one project is to be chosen which has the earliest payback period; hence, Project C is acceptable.

(ii) & (iv) **Computation of Discounted payback Period & NPV**

Time	P.V.F	A			B			C			D		
		Amt.	P.V	Cumu. P.V.	Amt.	P.V	Cumu. P.V.	Amt.	P.V.	Cumu P.V.	Amt.	P.V.	Cum. P.V.
0	1	(10,000)	(10,000)	-	(10,000)	(10,000)	-	(3,500)	(3,500)	-	(3,000)	(3,000)	-
(A)			(10,000)			(10,000)			(3,500)			(3,000)	-
1	0.9091	6,000	5,455	5,455	2,500	2,273	2,273	1,500	1,364	1,364	0	0	0
2	0.8262	2,000	1,652	7,107	2,500	2,066	4,339	2,500	2,066	3,430	0	0	0
3	0.7513	2,000	1,503	8,610	5,000	3,757	8,096	500	376	3,806	3,000	2,254	2,254
4	0.683	12,000	8,196	16,806	7,500	5,123	13,219	5,000	3,415	7,221	6,000	4,098	6,352
(B)			16,806			13,219			7,221			6,352	
NPV (B – A)			6,806			3,219			3,721			3,352	

Discounted PBP	A	B	C	D
	3 Years + $\frac{1,390}{8,196}$ = 3.17 Years	3 Years + $\frac{1,904}{5,123}$ = 3.37 Years	2 Years + $\frac{70}{376}$ = 2.19 Years	3 Years + $\frac{746}{4,098}$ = 3.18 Years

If standard discounted payback period is 2 years, no project is acceptable on discounted payback period criterion.
If standard discounted payback is 3 years, Project 'C' is acceptable on discounted payback period criterion.
According to NPV Technique Project A is the best. Project A is acceptable under the NPV method. The NPV method gives a better mutually exclusive choice than PI method. The NPV method guarantees the choice of the best alternative.

Solution 25:

Statement showing the computation of present value of cash flows:

Net Cash Flows		Present discounted value @				
Year	₹	11%	12%	13%	14%	15%
1	70,000	63,063	62,503	61,950	61,390	60,872
2	1,00,000	81,160	79,720	78,310	76,950	75,610

3	1,30,000	95,056	92,534	90,103	87,750	86,775
4	90,000	59,283	57,195	55,197	53,289	51,462
5	60,000	35,610	34,044	32,568	31,164	29,832
	Total	3,34,172	3,25,996	3,18,128	3,10,543	3,04,551

Note: Cash Flows in years 1 to 4 is the cash profit before depreciation and after tax. In the fifth year, the amount also includes ₹ 5,500 the expected scrap value and ₹ 40,000, the working capital to be released (₹ 14,500 + ₹ 5,500 + ₹ 40,000 = ₹ 60,000). At 14% the inflows are almost equal to the outflow. The project hence yields 14%.

Solution 26:

Computation of NPV (at 12%)

Particulars	1	2	3	4	5
CFBT	160	160	180	180	150
Less: Depreciation (20%)	(80)	(64)	(51.2)	(40.96)	(163.84)
EBT	80	96	128.8	139.04	(13.84)
Less: Tax (50%)	(40)	(48)	(64.4)	(69.52)	6.92
CFAT	120	112	115.60	110.48	156.92
P.V. Factor	0.89	0.80	0.71	0.64	0.57
PVCI	106.8	89.6	82.076	70.707	89.444

PVCI = 438.62
PVCO = 400
NPV = 38.62
Computation of NPV (at 15%)
NPV = [(120 × 0.862) + (112 × 0.74) + (115.60 × 0.64) + (110.48 × 0.55) + (156.92 × 0.48)] – 400
= 396.15 – 400 = ₹ (3.85)
IRR = 12% + 4% × $\frac{38.62}{42.47}$ = 15.63%

Solution 27:

1. **Cost of Project M**

At 15% I.R.R., the sum total of cash inflows = Cost of the project i.e. Initial cash outlay given:

Annual cost saving	₹ 40,000
Useful life	4 years
I.R.R.	15%

Now, considering the discount factor table @ 15% cumulative present value of cash inflows for 4 years is 2.885
Therefore,

Total of cash inflows for 4 years for Project M is (₹ 40,000 × 2.855)	₹ 1,14,200
Hence, cost of the project is	₹ 1,14,200

2. **Payback Period of the Project M**

Payback Period = $\frac{Cost\ of\ the\ project}{Annual\ cost\ saving}$
= $\frac{₹1,14,200}{40,000}$ = 2.855 or 2 years 11 months approximately.

3. **Cost of Capital**

If the profitability index (PI) is 1, cash inflows and outflows would be equal. In this case, (PI) is 1.064.

Profitability Index (PI) = $\frac{Discounted\ cash\ inflows}{Cost\ of\ the\ project}$

1.064 = $\frac{Discounted\ cash\ inflows}{₹1,14,200}$

1.064 × ₹ 1,14,200 = ₹ 1,21,509

Hence, Discounted cash inflows = ₹ 1,21,509

Since, Annual cost saving is ₹ 40,000. Hence, cumulative discount factor for 4 years

= $\frac{₹1,21,509}{40,000}$ = 3.037725 or 3.038

Considering the discount factor table at a discount rate of 12%, the cumulative discount factor for 4 years is 3.038.
Hence, the cost of capital is 12%.

4. **Net present value of the project**

N.P.V. = Total present values of cash inflows – Cost of the project
= ₹ 1,21,509 – ₹ 1,14,200 = ₹ 7,309

Solution 28:

1. Present value of 6 instalments = Annual Instalment x Annuity Factor at 12% = $\frac{₹6,15,000}{6\ years}$ × 4.111 = ₹ 4,21,378
2. Present value of lump sum payment = Given = ₹ 5,00,000
3. Conclusion: Instalment Option preferable, since PV of Outflows is lower.

Solution 29:

Statement of Operating Profit from processing of waste (₹ in lakh)

Year	1	2	3	4
Sales :(A)	966	966	1,254	1,254
Material consumption	90	120	255	255
Wages	180	195	255	300
Other expenses	120	135	162	210
Factory overheads (insurance only)	90	90	90	90
Loss of rent on storage space (opportunity cost)	30	30	30	30
Interest @14%	84	63	42	21
Depreciation (as per income tax rules)	150	114	84	63
Total cost: (B)	744	747	918	969
Profit (C)=(A)-(B)	222	219	336	285
Tax (30%)	66.6	65.7	100.8	85.5
Profit after Tax (PAT)	155.4	153.3	235.2	199.5

Statement of Incremental Cash Flows **(₹ in lakh)**

Year	0	1	2	3	4
Material stock	(60)	(105)	-	-	165
Compensation for contract	(90)	-	-	-	-
Contract payment saved	-	150	150	150	150
Tax on contract payment	-	(45)	(45)	(45)	(45)
Incremental profit	-	222	219	336	285
Depreciation added back	-	150	114	84	63
Tax on profits	-	(66.6)	(65.7)	(100.8)	(85.5)
Loan repayment	-	(150)	(150)	(150)	(150)
Profit on sale of machinery (net)	-	-	-	-	15
Total incremental cash flows	(150)	155.4	222.3	274.2	397.5
Present value factor	1.00	0.877	0.769	0.674	0.592
Present value of cash flows	(150)	136.28	170.95	184.81	235.32
Net present value	577.36				

Advice: Since the net present value of cash flows is ₹ 577.36 lakh which is positive the management should install the machine for processing the waste.

Solution 31:

Statement Showing the Evaluation of Two Machines

	Particulars	Machine 'X'	Machine 'Y'
(i)	Purchase Cost	₹ 15,00,000	₹ 10,00,000
(ii)	Life of Machine	3 years	2 years
(iii)	Running Cost of Machine per year	₹ 4,00,000	₹ 6,00,000
(iv)	PVIFA (0.09, 3)	2.531	
	PVIFA (0.09, 2)		1.759
(v)	PV of Running Cost of Machine {(iii) × (iv)}	₹ 10,12,400	₹ 10,55,400
(vi)	Cash outflows of Machine {(i) + (v)}	₹ 25,12,400	₹ 20,55,400
(vii)	Equivalent PV of Annual Cash outflow {(vi)/(iv)}	₹ 9,92,651	₹ 11,68,505

Recommendation: Ae Bee Cee Ltd. should buy Machine 'X' since equivalent annual cash outflow is less than that of Machine 'Y'.

Solution 32:

Computation of Initial Cash Outflows: (0 Period)

Cost of Equipment	₹ 6,00,000
(+) Net Working Capital	₹ 80,000
Initial Cash Outflows	₹ 6,80,000

Computation of Present Value of Cash Inflows(In ₹)

Particulars	1	2	3	4	5
Cash Inflows Before Tax (C.F.B.T.) (A)	2,40,000	2,75,000	2,10,000	1,80,000	1,60,000
Less: Depreciation (₹ 6,00,000/5)	(1,20,000)	(1,20,000)	(1,20,000)	(1,20,000)	(1,20,000)
Profits before Tax (PBT)	(1,20,000)	1,55,000	90,000	60,000	40,000
Tax Liability (35%) (B)	(42,000)	(54,250)	(31,500)	(21,000)	(14,000)
C.F.A.T. (A) – (B)	1,98,000	2,20,750	1,78,500	1,59,000	1,46,000
P.V. Factor (12%)	0.8929	0.7972	0.7118	0.6355	0.5674
Present Value Cash Inflows	1,76,794	1,75,982	1,27,056	1,01,045	82,840

Terminal Value (Year 5) (80,000×0.5674) = 45,392

(1) Payback Period(In ₹)

Years	Cash Inflows	Cumulative Cash Inflows
1	1,98,000	1,98,000
2	2,20,750	4,18,750
3	1,78,500	5,97,250
4	1,59,000	7,56,250

Payback Period = 3 years + $\frac{₹82,750}{₹1,59,000}$ × 1 year = 3.52 years

(2) Discounted Payback Period(In ₹)

Years	Present Value of Cash Inflows	Cumulative Present Value of Cash Inflows
1	1,76,794	1,76,794
2	1,75,982	3,52,776
3	1,27,056	4,79,832
4	1,01,045	5,80,877
5	82,840 + 45,392 = 1,28,232	7,09,109

Discounted Payback Period = 4 years + $\frac{₹99,123}{₹1,28,232}$ = 4.773 years

(3) Net Present Value

N.P.V. = Present Value of Cash Inflows – Present Value of Cash Outflows
= ₹ 7,09,109–₹ 6,80,000= ₹ 29,109

(4) I.R.R.

Years	P.V. Factor (15%)	Cash Inflows	Present Value of Cash Inflows
1	0.8696	1,98,000	1,72,181
2	0.7561	2,20,750	1,66,909
3	0.6575	1,78,500	1,17,364
4	0.5718	1,59,000	90,916
5	0.4972	2,26,000	1,12,367
		Present Value of Cash Inflows	6,59,737

N.P.V. at 15% Cost of Capital = ₹ 6,59,737 – ₹ 6,80,000 = (₹ 20,263)

Discount Rate	N.P.V.
12%	₹ 29,109
15%	(₹ 20,263)

I.R.R. = 12% + $\frac{₹ 29,109}{₹49,372}$ × 3%

= 13.77%

Solution 34:

A hospital is considering to purchase

Analysis of Investment Decisions

Determination of Cash inflows	Situation-(i) Commission Income before taxes	Situation-(ii) Commission Income after taxes
Cash flow up-to 7th year:		
Sales Revenue	40,000	40,000
Less: Operating Cost	(7,500)	(7,500)
	32,500	32,500
Less: Depreciation (80,000 – 6,000) ÷ 8	(9,250)	(9,250)
Net Income	23,250	23,250
Tax @ 30%	(6,975)	(6,975)
Earnings after Tax (EAT)	16,275	16,275
Add: Depreciation	9,250	9,250
Cash inflow after tax per annum	25,525	25,525
Less: Loss of Commission Income	(8,400)	(12,000)
Net Cash inflow after tax per annum	17,125	13,525
In 8th Year:		
Net Cash inflow after tax	17,125	13,525
Add: Salvage Value of Machine	6,000	6,000
Net Cash inflow in year 8	**23,125**	**19,525**

Calculation of Net Present Value (NPV) and Profitability Index (PI)

	Particulars	PV factor @10%	Situation-(i) [Commission Income before taxes]	Situation-(ii) [Commission Income after taxes]
A	Present value of cash inflows (1st to 7th year)	4.867	83,347.38 (17,125 × 4.867)	65,826.18 (13,525 × 4.867)
B	Present value of cash inflow at 8th year	0.467	10,799.38 (23,125 × 0.467)	9,118.18 (19,525 × 0.467)
C	PV of cash inflows		94,146.76	74,944.36
D	*Less:* Cash Outflow	1.00	(80,000)	(80,000)
E	**Net Present Value (NPV)**		**14,146.76**	**(5,055.64)**
F	**PI = (C÷D)**		**1.18**	**0.94**

Recommendation: The hospital may consider purchasing of diagnostic machine in situation (i) where commission income is 12,000 before tax as NPV is positive and PI is also greater than 1. Contrary to situation (i), in situation (ii) where the commission income is net of tax, the recommendation is reversed to not purchase the machine as NPV is negative and PI is also less than 1.

Solution 37:

Calculation of Net Cash flows

Contribution = (400 – 375) ₹ 80,000 = ₹ 20,00,000

Fixed costs = 10,40,000 – [(40,00,000 – 5,00,000)/5] = ₹ 3,40,000

Year	Capital (₹)	Contribution (₹)	Fixed costs (₹)	Promotion (₹)	Net cash flow (₹)
0	(32,00,000)				(32,00,000)
1	(8,00,000)	20,00,000	(3,40,000)	(1,25,000)	7,35,000
2		20,00,000	(3,40,000)	(1,75,000)	14,85,000
3		20,00,000	(3,40,000)		16,60,000
4		20,00,000	(3,40,000)		16,60,000
5	5,00,000	20,00,000	(3,40,000)		21,60,000

Calculation of Net Present Value

Year	Net cash flow (₹)	12% discount factor	Present value (₹)
0	(32,00,000)	1.000	(32,00,000)
1	7,35,000	0.893	6,56,355
2	14,85,000	0.797	11,83,545
3	16,60,000	0.712	11,81,920
4	16,60,000	0.636	10,55,760
5	21,60,000	0.567	12,24,720
			21,02,300

The net present value of the project is **₹21,02,300.**

Solution 38:

1. **Computation of CFAT from the projects**

Particulars	Machine – I	Machine – II
Annual Income before Tax and Depreciation	₹ 3,45,000	₹ 4,55,000
Less: Depreciation = $\frac{Cost\ of\ Machine - Salvage\ Value}{Number\ of\ Years}$	$\frac{₹10,00,000}{5\ years}$ = ₹ 2,00,000	$\frac{₹15,00,000}{6\ years}$ = ₹ 2,50,000
PBT	₹ 1,45,000	₹ 2,05,000
Less: Tax at 30%	₹ 43,500	₹ 61,500
PAT	₹ 1,01,500	₹ 1,43,500
CFAT = PAT + Depreciation	₹ 3,01,500	₹ 3,93,500

2. **Computation of NPV (at 12% Cost of Capital) and Cumulative DCFAT(In ₹)**

Year	PVF at 12%	Machine – I			Machine – II		
		CFAT	PV	CumulativePV	CFAT	PV	CumulativePV
1	0.893	3,01,500	2,69,240	2,69,240	3,93,500	3,51,396	3,51,396
2	0.797	3,01,500	2,40,296	5,09,536	3,93,500	3,13,619	6,65,016
3	0.712	3,01,500	2,14,668	7,24,204	3,93,500	2,80,172	9,45,188
4	0.636	3,01,500	1,91,754	9,15,958	3,93,500	2,50,266	11,95,454
5	0.567	3,01,500	1,70,951	10,86,909	3,93,500	2,23,115	14,18,569
6	0.507	Nil	Nil	NA	3,93,500	1,99,505	16,18,074
Total PVCI			10,86,909			16,18,074	
Less: Initial Investment (PVCO)			10,00,000			15,00,000	
Net Present value			86,909			1,18,074	

Note: Since discounted payback period is to be calculated, cumulative PV should be computed at the end of the year.

3. **Discounted Payback Period**

Machine I

Discounted Payback Period = 4 + $\frac{(₹10,00,000 - ₹9,15,958)}{₹1,70,951}$ = 4.49 years

Machine II

Discounted Payback Period = 5 + $\frac{(₹15,00,000 - ₹14,18,569)}{₹1,,99,505}$ = 5.41 years

4. Internal Rate of Return

Machine I

Internal Rate of Return = 12% + $\frac{₹86,909}{[₹86,909 — ₹\ 12,889]}$ × (16% – 12%) = 15.48%

Machine II

Internal Rate of Return = 12% + $\frac{₹1,18,074}{[₹1,18,074 - (-₹50,346)]}$ × (16% – 12%) = 14.80%

5. Decision/Project Choice

Criterion	Machine I	Machine II	Preference
NPV at 12% cost of capital	₹ 86,909	₹ 1,18,074	Machine II
IRR	15.48%	14.80%	Machine II
Discounted payback period	4 years 6 months	5 years 5 months	Machine II
Equivalent Annual Flows	$\frac{₹\ 86,909}{3.605}$ =₹ 24,108	$\frac{₹\ 1,18,074}{4.112}$ = ₹ 28,714	Machine II

In this case, Machine I and II have differential lives and hence Equivalent Annual Flow Method will be a better method for project ranking. Equivalent Annual Flows from the project = $\frac{NPV}{Annuity\ Factor\ at\ 12\%\ for\ Project\ Life\ Years}$

Solution 39:

Working Notes:

Depreciation on Machine X = $\frac{1,50,000}{5}$ = ₹ 30,000

Depreciation on Machine Y = $\frac{2,40,000}{6}$ = ₹ 40,000

Particulars	Machine X (₹)	Machine Y (₹)
Annual Savings:		
Wages	90,000	1,20,000
Scrap	10,000	15,000
Total Savings (A)	1,00,000	1,35,000
Annual Estimated Cash Cost:		
Indirect Material	6,000	8,000
Supervision	12,000	16,000
Maintenance	7,000	11,000
Total Cash Cost (B)	25,000	35,000
Annual Cash Savings (A-B)	75,000	1,00,000
Less: Depreciation	30,000	40,000
Annual Savings Before Tax	45,000	60,000
Less: Tax @ 30%	13,500	18,000
Annual Savings/Profit (After Tax)	31,500	42,000
Add: Depreciation	30,000	40,000
Annual Cash Inflows		

Evaluation of Alternatives

(i) **Average Rate of Return Method (ARR)**

ARR = $\frac{Average\ Annual\ Net\ Savings}{Average\ Investment}$

Machine X = $\frac{31,500}{75,000}$ x 100 = 42%

Machine Y = $\frac{42,000}{120,000}$ × 100 = 35%

Decision: Machine X is better.

[Note: ARR can be computed alternatively taking initial investment as the basis for computation (ARR = Average Annual Net Income/Initial Investment). The value of ARR for Machines X and Y would then change accordingly as 21% and 17.5% respectively]

(ii) **Present Value Index Method**

Present Value = Annual Cash Inflow x P.V. Factor @ 10%
Machine X = 61,500 × 3.79
= ₹ 2, 33,085
Machine Y = 82,000 × 4.354
= ₹ 3, 57,028

P.V. Index = $\frac{Present\ Value}{Investment}$

Machine X = $\frac{2,33,085}{1,50,000}$ = 1.5539

Machine Y = $\frac{3,57,028}{2,40,000}$ = 1,487

Solution 40:

(i) **Net Present Value at different discounting rates**

Project	0% (₹)	10% (₹)	15% (₹)	30% (₹)	40% (₹)
C	8000	4139	2654	- 632	- 2158
	{2000 + 4000 + 12000 - 10000}	{2000 x 0.909 + 4000 x 0.8264 + 12000 x 0.7513 - 10000}	{2000 x 0.8696 + 4000 x 0.7561 + 12000 x 0.6575 - 10,000}	{2000 x 0.7692 + 4000 x 0.5917 + 12000 x 0.4552 - 10,000}	{2000 x 0.7143 + 4000 x 0.5102 + 12000 x 0.3644 - 10,000}
Ranking	I	I	II	II	II
D	6000	3823	2937	833	-233
	{10000 + 3000 + 3000 - 10000}	{10000 x 0.909 + 3000 x 0.8264 + 3000 x 0.7513 - 10000}	{10000 x 0.8696 + 3000 x 0.7561 + 3000 x 0.6575 - 10,000}	{10000 x 0.7692 + 3000 x 0.5917 + 3000 x 0.4552 - 10,000}	{10000 x 0.7143 + 3000 x 0.5102 + 3000 x 0.3644 - 10,000}

The conflict in ranking arises because of skewness in cash flows. In the case of Project C cash flows occur later in the life and in the case of Project D, cash flows are skewed towards the beginning.
At lower discount rate, project C's NPV will be higher than that of project D. As the discount rate increases, Project C's NPV will fall at a faster rate, due to compounding effect.
After break even discount rate, Project D has higher NPV as well as higher IRR.

(ii) If the opportunity cost of funds is 10%, project C should be accepted because the firm's wealth will increase by ₹ 316 (₹ 4,139 - ₹ 3,823).
The following statement of incremental analysis will substantiate the above point.

Project	Cash Flows (₹)				NPV @ 10% (₹)	IRR 12.5%
	C0	C1	C2	C3		
C-D	0	- 8,000	1,000	9,000	316 {- 8000 x 0.909 + 1000 x 0.8264 + 9000 x 0.7513}	0 {- 8000 x 0.88884 + 1000 x 0.7898 + 9000 x 0.7019}

Hence, the project C should be accepted, when opportunity cost of funds is 10%.

Solution 41:

1. **Computation of NPV(In ₹ 000s)**

Years	PVF	PVF	Project A			Project B				
	10%	20%	CFAT	PVCI at 10%	PVCI at 20%	CFAT	PVCI at 10%	PVCI at 20%	PVF at 27%	PVCI at 27%
1	0.91	0.83	85	77.35	70.55	480.00	436.80	398.40	0.79	379.20
2	0.83	0.69	200	166.00	138.00	100.00	83.00	69.00	0.62	62.00
3	0.75	0.58	240	180.00	139.20	70.00	52.50	40.60	0.49	34.30
4	0.68	0.48	220	149.60	105.60	30.00	20.40	14.40	0.38	11.4
5	0.62	0.41	70	43.40	28.70	20.00	12.40	8.20	0.30	6.00
Total PVCI				616.35	482.05		605.10	530.60		492.90
Less: Initial Investment (PVCO)				500.00	500.00		500.00	500		500
NPV				116.35	(17.95)		105.10	30.60		(7.10)

2. **Project A:**

IRR = $10\% + \frac{116.35}{[116.35-(-17.95)]} \times 10 = 18.66\%$

Project B:

IRR = $10\% + \frac{105.10}{[(105.10-(-7.10)]} \times 17 = 25.92\%$

3. **Decision:**

Particulars	Project A	Project B	Preference
NPV at K_0 (i.e. 10%)	116.35	105.10	Project A
IRR	18.66%	25.92%	Project B

In case of inconsistency in ranking based on NPV and IRR, NPV-based decision-making is preferable. So, in this case, project A is preferable due to higher NPV.

Solution 42:

Option I: Purchase Machinery and Service Part at the end of Year 1.

Net Present value of cash flow @ 10% per annum discount rate.

NVP (in ₹) = $- 1,00,000 + \frac{36,000}{(1.1)} + \frac{36,000}{(1.1)2} + \frac{36,000}{(1.1)3} - \frac{20,000}{(1.1)} + \frac{25,000}{(1.1)3}$

= - 1,00,000 + 36,000 (0.9091 + 0.8264 + 0.7513) – (20,000 x 0.9091) + (25,000 x 0.7513)

= - 1,00,000 + (36,000 x 2.4868) – 18,182 + 18,782.5

= - 1,00,000 + 89,524.8 – 18,182 + 18,782.5

NPV = - 9,874.7

Since, Net Present Value is negative; therefore, this option is not to be considered.

If Supplier gives a discount of ₹ 10,000 then,

NPV (in ₹) = + 10,000 – 9,874.7 = + 125.3

In this case, Net Present Value is positive but very small; therefore, this option may not be advisable.

Option II: Purchase Machinery and Replace Part at the end of Year 2.

NVP (in ₹) = $- 1,00,000 + \frac{36,000}{(1.1)} + \frac{36,000}{(1.1)2} + \frac{36,000}{(1.1)3} - \frac{30,800}{(1.1)2} + \frac{54,000}{(1.1)4}$

= - 1,00,000+ 36,000 (0.9091 + 0.8264 + 0.7513) – (30,800 x 0.8264) + (54,000 x 0.6830)

= - 1,00,000 + 36,000 (2.4868) – 25,453.12 + 36,882

= - 1,00,000 + 89,524.8 – 25,453.12 + 36,882

NPV = + 953.68

Net Present Value is positive, but very low as compared to the investment.

If the Supplier gives a discount of ₹ 10,000, then

NPV (in ₹) = 10,000 + 953.68 = 10,953.68

Decision: Option II is worth investing as the net present value is positive and higher as compared to Option I.

Solution 43:

(i) Project Initial Net Cash Outflow

Particulars	₹
Purchase Price of system	2,00,000
(+) Installation Cost	50,000

	2,50,000

(ii) (a) Project Terminal Cash Inflows	₹
Scrap Value of Computer	0

(b) **Project operating cash Inflows**

Particulars	₹
Saving in annual salaries of Clerical Staff (₹ 15,000 × 10)	1,50,000
Add: Saving from reduced production delays	8,000
Add: Saving from lost sales due to inventory stock out	12,000
Add: Saving due to timely billing procedures	3,000
Gross Saving	1,73,000
Less: Annual salaries of two computer specialists	(80,000)
Less: Annual maintenance and operating (cash) expenses	(12,000)
C.F.B.T. (1)	81,000
Less: Depreciation (₹ 2,50,000/5)	(50,000)
P.B.T.	31,000
Tax liability (2)	12,400
C.F.A.T. (1) – (2)	68,600

Statement showing evaluation of proposal(In ₹)

Particulars	Time	Present value factor	Amount	Present value
Cash Outflows:				
Cost of Machine	0	1	2,50,000	2,50,000
				2,50,000
Cash Inflows:				
C.F.A.T.	1-5	3.605	68,600	2,47,303
				2,47,303
Net Present Value				(2,697)

(iv) **Profitability Index** = $\frac{₹\ 2,47,303}{₹\ 2,50,000}$ = 0.989

(v) Pay Back Period = $\frac{₹\ 2,50,000}{₹\ 68,600}$ = 3.64 years

(vi) (a) Cash outflows (0 Period) = ₹ 2,50,000

(b) Cash inflows = CFAT (1-5) = ₹ 68,600

(c) **Terminal value**

Particulars	(5 Period) (In ₹)
S.P. (1)	25,000
W.D.V.	0
Capital gain	25,000
Tax rate	40%
Less: Tax Liability (2)	10,000
Terminal value (1) – (2)	15,000

(d) **Statement showing Evaluation of Proposal(In ₹)**

Particulars	Time	Present value factor	Amount	Present value
Cash Outflows:				
Cost of machine	0	1	2,50,000	2,50,000
Present Value of Cash Outflows (A)				2,50,000
Cash Inflows:				
CFAT	1-5	3.605	68,600	2,47,303

Terminal Value	5	0.567	15,000	8,505
Present Value of Cash Inflows (B)				2,55,808
Net Present Value (B) – (A)				5,808

(vii) (a) Cash Outflows = 0 period = ₹ 2,50,000

(b) **Cash Inflows CFAT**

Particulars	(1-5) (In ₹)
C.F.B.T (1)	81,000
Less: Depreciation	46,000
P.B.T.	35,000
Tax rate	40%
Tax Liability (2)	14,000
CFAT (1) – (2)	67,000

(c) **Terminal Value**

Particulars	(Yr 5) (In ₹)
S.P. (1)	0
(-) WDV	20,000
Capital Loss:	(20,000)
Tax rate	40%
Tax Saving (2)	8,000
Terminal Value {(1) + (2)}	8,000

(d) **Statement showing evaluation of Proposal(In ₹)**

Particulars	Time	Present value factor	Amount	Present value
Cash Outflows:				
Cost of machine	0	1	2,50,000	2,50,000
Present Value of Cash Outflows (A)				2,50,000
Cash Inflows:				
CFAT	1-5	3.605	67,000	2,41,535
Terminal Value	5	0.567	8,000	4,536
Present Value of Cash Inflows (B)				2,46,071
Net Present Value (B) – (A)				(3,929)

Solution 45:

Gross electricity gene = 25 lakhs unit p.a.
Free commitment (4%) = 1 lakh unit p.a.
Net chargeable electricity generate = 24 lakhs unit p.a.

Computation of Annual Cash Flow

Period	Rate per unit (₹)	Revenue (₹) (A)	Maintenance cost (₹) (B)	Profit Before Tax (₹) (C)= (A)-(B)	Tax @ 50%(₹) (D)	Profit after Tax (₹) (C)-(D)
1	2.25	54,00,000	4,00,000	50,00,000	25,00,000	25,00,000
2	2.50	60,00,000	6,00,000	54,00,000	27,00,000	27,00,000
3	2.75	66,00,000	8,00,000	58,00,000	29,00,000	29,00,000
4	3.00	72,00,000	10,00,000	62,00,000	31,00,000	31,00,000
5	3.25	78,00,000	12,00,000	66,00,000	33,00,000	33,00,000
6	3.50	84,00,000	14,00,000	70,00,000	35,00,000	35,00,000
7	3.75	90,00,000	16,00,000	74,00,000	37,00,000	37,00,000
8	4.25	102,00,000	18,00,000	84,00,000	42,00,000	42,00,000
9	4.75	114,00,000	20,00,000	94,00,000	47,00,000	47,00,000

10	5.25	126,00,000	22,00,000	104,00,000	52,00,000	52,00,000

Computation of Net Present Value

Period	Annual Cash Flow (₹)	Subsidy (₹)	Tax Benefit on Machine Depreciation (₹)	Sale of Land (₹)	Total Cash Inflow (₹)	PVF @15%	PV (₹)
1	25,00,000	25,00,000	140,00,000	-	1,90,00,000	0.87	165,30,000
2	27,00,000	-	-	-	27,00,000	0.756	20,41,200
3	29,00,000	-	-	-	29,00,000	0.658	19,08,200
4	31,00,000	-	-	-	31,00,000	0.572	17,73,200
5	33,00,000	-	-	-	33,00,000	0.497	16,40,100
6	35,00,000	-	-	-	35,00,000	0.432	15,12,000
7	37,00,000	-	-	-	37,00,000	0.376	13,91,200
8	42,00,000	-	-	-	42,00,000	0.327	13,73,400
9	47,00,000	-	-	-	47,00,000	0.284	13,34,800
10	52,00,000	-	-	90,00,000	142,00,000	0.247	35,07,400
Total Present Value of Cash Inflows							3,30,11,500
Less: Initial Outlay							3,10,00,000
Net Present Value							20,11,500

The proposed project has NPV of ₹ 20,11,500 and is viable to undertake.

Solution 46:

Statement showing evaluation of replacement proposal (₹ in Lakhs)

Particulars	Time	PV Factor	Amount	Present value
Cash Outflows:				
Cost of new computer			35	
Less: Scrap of old drawing office & equipment furniture			(9)	
Net Cost of replacement	0	1	26	26
P.V. of C.O.				26
Cash Inflows:				
Incremental CFAT	1-6	4.018	2.5	10.27
Tax Saving on depreciation	1	0.892	17.5	15.6
Terminal Value	6	0.506	1.0	0.506
				26.386
Net Present Value				26.386 – 26 = 0.386

Computation of Incremental CFAT (₹ in Lakhs)

Particulars	1-6 Years
Savings in operating cost	12
Less: Operating maintenance cost of computer	(7)
Incremental CFBT	5
Less: Tax 50%	2.5
Incremental CFAT Excluding tax savings on depreciation	2.5

Depreciation	35
Tax rate	50%
Tax savings on Depreciation	17.5

Solution 48:

Workings:

Calculation of Depreciation:

On Modernized Equipment = $\frac{\text{Rs } 1,40,000 - \text{Rs } 30,000}{5 \text{ years}}$ = Rs 22,000 p.a.

On New Machine $= \frac{Rs\ 3,50,000 - Rs\ 60,000}{5\ years}$ = Rs 58,000 p.a.

(i) **Calculation of Incremental annual cash inflows/ savings:**

Particulars	Existing Equipment (Rs)	Modernization		New Machine	
		Amount (Rs)	Savings (Rs)	Amount (Rs)	Savings (Rs)
	(1)	(2)	(3)=(1)-(2)	(4)	(5)=(1)-(4)
Wages & Salaries	45,000	35,500	9,500	15,000	30,000
Supervision	20,000	10,000	10,000	7,000	13,000
Maintenance	25,000	5,000	20,000	2,500	22,500
Power	30,000	20,000	10,000	15,000	15,000
Total	1,20,000	70,500	49,500	39,500	80,500
Less: Depreciation (Refer Workings)			22,000		58,000
Total Savings			27,500		22,500
Less: Tax @ 50%			13,750		11,250
After Tax Savings			13,750		11,250
Add: Depreciation			22,000		58,000
Incremental Annual Cash Inflows			35,750		69,250

(ii) **Calculation of Net Present Value (NPV)**

Particulars	Year	Modernization (Rs)	New Machine (Rs)
Initial Cash outflow (A)	0	1,40,000.00	3,50,000.00
Incremental Cash Inflows	1-5	1,35,492.50 (Rs 35,750 x 3.790)	2,62,457.50 (Rs 69,250 x 3.790)
Salvage value	5	18,630.00 (Rs 30,000 x 0.621)	37,260.00 (Rs 60,000 x 0.621)
PV of Cash inflows (B)		1,54,122.50	2,99,717.50
Net Present Value (B - A)		14,122.50	(50,282.50)

Advise: The company should modernize its existing equipment and not buy a new machine because NPV is positive in modernization of equipment.

Solution 49:

1. Initial Investment = Machine Purchase price + Modification charges + Installation Charges + Testing Charges
   = ₹ 9,00,000 + ₹ 30,000 + ₹ 60,000 + ₹ 90,000 = ₹ 10,80,000.
2. Salvage Value = ₹ 1,80,000
3. Life = 3 years
4. Depreciation p.a. = $\frac{₹10,80,000 - ₹1,80,000}{3\ years}$ = ₹ 3,00,000 (same as charged in P&L Account given in Question).
5. **Computation of CFAT p.a. and NPV:(In ₹)**

Particulars	Year I	Year II	Year III
Sales	10,00,000	20,00,000	8,00,000
Less: Relevant Costs:			
Materials and Labour	(4,00,000)	(7,50,000)	(3,50,000)
Rent Expense	(50,000)	(50,000)	(50,000)
Depreciation	(3,00,000)	(3,00,000)	(3,00,000)
Rent Income foregone	(37,500)	(37,500)	(37,500)
Total Costs	7,87,500	11,37,500	7,37,500
Profit After Tax	2,12,500	8,62,500	62,500
Less: Tax at 50%	(1,06,250)	(4,31,250)	(31,250)
Profit After Tax	1,06,250	4,31,250	31,250
Add: Depreciation	3,00,000	3,00,000	3,00,000
CFAT	4,06,250	7,31,250	3,31,250
Add: Salvage value of Machine	-	-	1,80,000
PVF at 20%	0.8333	0.6944	0.5787

Present Value	3,38,528 (a)	5,07,780 (b)	2,95,860 (c)
Total Present Value (a) + (b) + (c) Less: Initial Investment	11,42,168 10,80,000		
NPV	62,168		

Solution 50:

Statement showing computation of Annual CFAT(In ₹)

Particulars	1	2	3	4	5
Savings in Accommodation Expenses	8,00,000	10,00,000	12,00,000	14,00,000	16,00,000
Less: Annual Maintenance Cost	(1,50,000)	(1,50,000)	(1,50,000)	(1,50,000)	(1,50,000)
Add: Saving in Boarding Charges	50,000	50,000	50,000	50,000	50,000
Add: Saving in Executive Training Programmes	2,00,000	2,00,000	2,00,000	2,00,000	2,00,000
CFBT (1)	9,00,000	11,00,000	13,00,000	15,00,000	17,00,000
Less: Depreciation	3,00,000	3,00,000	3,00,000	3,00,000	3,00,000
PBT	6,00,000	8,00,000	10,00,000	12,00,000	14,00,000
Less: Tax (2)	3,00,000	4,00,000	5,00,000	6,00,000	7,00,000
CFAT	6,00,000	7,00,000	8,00,000	9,00,000	10,00,000
PVF	0.87	0.76	0.66	0.57	0.50
PVCI	5,22,000	5,32,000	5,28,000	5,13,000	5,00,000

PVCI = ₹ 25,95,000

NPV = ₹ 25,95,000 – ₹ 15,00,000 = ₹ 10,95,000

Notes: 1. No other alternative use of land has been given hence it will not be considered for evaluation of Proposal.

2. Consultants Remuneration, Travel and Conveyance & special allowances will continue to be incurred, hence is ignored.

Solution 51:

Computation of Annual Cash Flow after Tax						
Particulars	**Year 0**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Savings in Salaries		15,00,000	15,00,000	15,00,000	15,00,000	15,00,000
Reduction in Production Delays		3,00,000	3,00,000	3,00,000	3,00,000	3,00,000
Reduction in Lost Sales		2,50,000	2,50,000	2,50,000	2,50,000	2,50,000
Gain due to Timely Billing		2,00,000	2,00,000	2,00,000	2,00,000	2,00,000
Salary to Computer Specialist		(10,00,000)	(10,00,000)	(10,00,000)	(10,00,000)	(10,00,000)
Maintenance and Operating Cost (payable in advance)		(2,00,000)	(1,80,000)	(1,60,000)	(1,40,000)	(1,20,000)
Depreciation (21 lakhs/5)		(4,20,000)	(4,20,000)	(4,20,000)	(4,20,000)	(4,20,000)
Gain Before Tax		6,30,000	6,50,000	6,70,000	6,90,000	7,10,000
Less: Tax (30%)		1,89,000	1,95,000	2,01,000	2,07,000	2,13,000
Gain After Tax		4,41,000	4,55,000	4,69,000	4,83,000	4,97,000
Add: Depreciation		4,20,000	4,20,000	4,20,000	4,20,000	4,20,000
Add: Maintenance and Operating Cost (payable in advance)		2,00,000	1,80,000	1,60,000	1,40,000	1,20,000
Less: Maintenance and Operating Cost (payable in advance)	(2,00,000)	(1,80,000)	(1,60,000)	(1,40,000)	(1,20,000)	-
Net CFAT	(2,00,000)	8,81,000	8,95,000	9,09,000	9,23,000	10,37,000

Note: Annual cash flows can also be calculated Considering tax shield on depreciation & maintenance and operating cost. There will be no change in the final cash flows after tax.

Computation of NPV				
Particulars	**Year**	**Cash Flows (₹)**	**PVF**	**PV (₹)**
Initial Investment (80% of 20 Lacs)	0	16,00,000	1	16,00,000
Installation Expenses	0	1,00,000	1	1,00,000
Instalment of Purchase Price	1	4,00,000	0.870	3,48,000
PV of Outflows (A)				**20,48,000**
CFAT	0	(2,00,000)	1	(2,00,000)
CFAT	1	8,81,000	0.870	7,66,470
CFAT	2	8,95,000	0.756	6,76,620
CFAT	3	9,09,000	0.658	5,98,122
CFAT	4	9,23,000	0.572	5,27,956
CFAT	5	10,37,000	0.497	5,15,389
PV of Inflows (B)				**28,84,557**
NPV (B-A)				**8,36,557**
Profitability Index (B/A)				**1.408 or 1.41**

Evaluation: Since the NPV is positive (i.e. ₹8,36,557) and Profitability Index is also greater than 1 (i.e. 1.41), Alpha Ltd. may introduce artificial intelligence (AI) while making computers.

Solution 52:

Let the total value of machine necessary for replacement be x.

(a) Statement showing determination of cost of New Machine

Cash Outflows:				
Cost of new Machine			X	
Less: Scrap value of old machine			(5,00,000)	
Net cost of replacement	0	1	x – 5,00,000	x – 5,00,000
PVCO (A)				x – 5,00,000
Cash Inflows:	1	0.87	60,000	52,200
CFAT				
	2	0.76	1,20,000	91,250
	3	0.66	1,80,000	1,18,800
	4	0.57	2,40,000	1,36,800
	5	0.49	3,00,000	1,47,000
Tax Savings on Depreciation	1-5	3.35	0.08 x – 40,000	0.268x – 1,34,000
PVCI (B)				0.268× + 4,12,000
NPV (B – A)				4,53,000

Working Notes:

(i) Computation of Incremental C.F.A.T.

Year	**1**	**2**	**3**	**4**	**5**
Incremental capacity	10%	20%	30%	40%	50%
Incremental Production and sales (kgs.)	10,000	20,000	30,000	40,000	50,000
	₹	₹	₹	₹	₹
Incremental Contribution	1,50,000	3,00,000	4,50,000	6,00,000	7,50,000
Less: Incremental Fixed Cost	(50,000)	(1,00,000)	(1,50,000)	(2,00,000)	(2,50,000)
Incremental PBT	1,00,000	2,00,000	3,00,000	4,00,000	5,00,000
Tax @ 40%	(40,000)	(80,000)	(1,20,000)	(1,60,000)	(2,00,000)
Incremental PAT	60,000	1,20,000	1,80,000	2,40,000	3,00,000

(ii) Tax savings on Incremental Depreciation= $\frac{Cost\ of\ new\ asset - Scrap\ Value\ of\ old\ Asset}{No.of\ year}$ × Tax Rates

= $\frac{x - 5,00,000}{5}$ × 40%

= (0.2x – 1,00,000) × 40%

= 0.08x – 40,000
NPV = PVCI – PVCO
4,53,000 = (0.268x + 4,12,000) – (x – 5,00,000)
x = ₹ 6,27,049

(b) Statement showing computation of N.P.V.

Particulars	Time	PVF	Amount	P.V.
Cash Outflows:				
Cost of new Machine			6,27,049	
Less: Scrap value of old machine			(5,00,000)	
Net Cost of replacement	0	1	1,27,049	1,27,049
PVCO (A)				1,27,049
Cash Inflows:				
CFAT	1	0.87	70,164	61,043
	2	0.76	1,90,164	1,44,525
	3	0.66	3,10,164	2,04,706
PVCI (B)				4,10,274
NPV				2,83,225

Comment: The filling of Managing Director is correct.

Working Notes:

1. Computation of Annual CFAT

Particulars	1	2	3
Incremental Production (unit)	10,000	30,000	50,000
Contribution (₹ 15 p.u.)	1,50,000	4,50,000	7,50,000
Less: Incremental F.C. (Example: Depreciation)	(50,000)	(1,50,000)	(2,50,000)
Incremental CFBT	1,00,000	3,00,000	5,00,000
Less: Incremental Depreciation 627049 – 5,00,000	(25,410)	(25,410)	(25,410)
Incremental PBT	74,590	2,74,590	4,74,590
Less: Tax 40%	(29,836)	(1,09,836)	(1,89,836)
	44,754	1,64,754	2,84,754
Add: Depreciation	25,410	25,410	25,410
	70,164	1,90,164	3,10,164

Solution 53:

Evaluation of proposal to repair existing machine or buy a new machine for M/s S. Engineering Company

(i) To repair Existing Machine:

Particulars	₹
Present value of after-tax cash outflows	
Cost of repairs immediately net of tax ₹9,500 (50% of ₹ 19,000)	
Equivalent annual cost for 5 years($\frac{₹9,500}{3.791}$)	2,506
Running and maintenance cost per annum net of tax (50% of ₹ 20,000)	10,000
Total net equivalent cash outflows p.a.	12,506

(ii) To buy a New Machine:

Particulars	₹
Present value of after-tax cash outflows	
Purchase cost of new machine	49,000
Less: Sale Proceeds of old machine	5,000
	44,000
Equivalent annual cost for 10 years($\frac{₹44,000}{6.145}$)	7,160

Tax saving of depreciation (₹ 49,000/10) × 50%	(2,450)
Running and maintenance cost p.a. net of tax (50% of ₹ 14,000)	7,000
Total net equivalent cash outflows per annum	11,710

Advise: The Company should go for buying a new machine.

Solution 54:

ABC & Co.

Equivalent Annual Cost (EAC) of new machine

		₹
(i)	Cost of new machine now	18,00,000
	Add: PV of annual repairs @ ₹ 2,00,000 per annum for 8 years (₹ 2,00,000 x 4.4873)	8,97,460
		26,97,460
	Less: PV of Salvage value at the end of 8 years (₹ 4,00,000 x 0.3269)	1,30,760
		25,66,700
	Equivalent annual cost (EAC) (₹ 25,66,700/4.4873)	5,71,992

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	(5,71,992)	1.00	(5,71,992)
	0	8,00,000	1.00	8,00,000
				2,28,008
Replace in one year	1	(5,71,992)	0.8696	(4,97,404)
	1	(2,00,000)	0.8696	(1,73,920)
	1	5,00,000	0.8696	4,34,800
				(2,36,524)
Replace in two years	1	(2,00,000)	0.8696	(1,73,920)
	2	(5,71,992)	0.7561	(4,32,483)
	2	(4,00,000)	0.7561	(3,02,440)
	2	3,00,000	0.7561	2,26,830
				(6,82,013)
Replace in three years	1	(2,00,000)	0.8696	(1,73,920)
	2	(4,00,000)	0.7561	(3,02,440)
	3	(5,71,992)	0.6575	(3,76,085)
	3	(6,00,000)	0.6575	(3,94,500)
	3	2,00,000	0.6575	1,31,500
				(11,15,445)
Replace in four years	1	(2,00,000)	0.8696	(1,73,920)
	2	(4,00,000)	0.7561	(3,02,440)
	3	(6,00,000)	0.6575	(3,94,500)
	4	(5,71,992)	0.5718	(3,27,065)
	4	(8,00,000)	0.5718	(4,57,440)
				(16,55,365)

Advice: The company should replace the old machine immediately because the PV of cost of replacing the old machine with new machine is least.

Solution 56:

(i) Calculation of Net Initial Cash Outflow:

Particulars	(₹.)	(₹.)
Cost of new machine		5,25,000
Less: Sale proceeds of existing machine	90,000	
Savings of tax on loss on sale of existing machine {₹. 1,87,500 - ₹. 90,000) x 0.3}	29,250	1,19,250
Net initial cash outflow		4,05,750

(ii) Calculation of annual depreciation:

On existing machine = $\frac{₹.\ 3,75,000}{10\ Years}$ = ₹. 37,500 p.a.

On new machine = $\frac{₹.\ 5,25,000 - ₹.\ 60,000}{5\ Years}$ = ₹. 93,000 p.a.

(iii) Calculation of annual cash inflows from operations

Particulars	Years	
	1-4 (₹.)	5 (₹.)
Savings in Variable Cost	2,40,000	2,40,000
Less: Savings in Depreciation (₹. 93,000 - ₹. 37,500)	55,500	0*
Savings before tax	1,84,500	2,40,000
Less: Tax @ 30%	55,350	72,000
Savings after Tax	1,29,150	1,68,000
Add: Savings in Depreciation	55,500	0
Incremental Cash Inflows	1,84,650	1,68,000

* No depreciation to be charged in the year of sale of machine.

(iv) Calculation of Net Present Value

Particulars	Period (Year)	Cash Flow (₹.)	P/V Factor @ 11%	Present Value (₹.)
Net Initial Cash Outflow	0	(4,05,750)	1.00	(4,05,750)
Incremental Cash Inflow	1 – 4	1,84,650	3.103	5,72,969
Incremental Cash Inflow	5	1,68,000	0.593	99,624
Salvage value of new machine	5	60,000	0.593	35,580
	5	27,900	0.593	16,545
Tax saving on Loss on sale of new machine		{(₹.1,53,000** - ₹.60,000) x 0.3}		
Net Present Value (NPV)				3,18,968

** WDV of new machine at the end of Year 5

Cost of New Machine	₹ 5,25,000
Less: Depreciation charged for 4 years (₹. 93,000 x 4)	₹ 3,72,000
	₹ 1,53,000

Comment: It is advisable to replace the existing machine since NPV is positive.

Solution 57:

Statement showing the evaluation of two machines

Machines	A	B
Purchase cost (₹) (i)	1,50,000	1,00,000
Life of machines (years)	3	2
Running cost of machine per year (₹) (ii)	40,000	60,000
Cumulative present value factor for 1-3 years @ 10% (iii)	2.486	-
Cumulative present value factor for 1-2 years @ 10% (iv)	-	1.735
Present value of running cost of machines (₹) (v)	99,440 [(ii) × (iii)]	1,04,100 [(ii) × (iv)]
Cash outflow of machines (₹) (vi) = (i) + (v)	2,49,440	2,04,100
Equivalent present value of annual cash outflow	1,00,338[(vi ÷ iii)]	1,17,637 [(vi) ÷ (iv)]

Decision: Company X should buy machine A since its equivalent cash outflow is less than machine B.

Solution 58:

Since project Lives are different, the Equivalent Annual Flows method is adopted.

Machine	A	B
1. Cost of Machine (Initial Investment)	₹ 6,00,000	₹ 4,00,000
2. Useful Life	2 Years	2 years

3. Depreciation per annum = (1) ÷ (2)	₹ 2,00,000	₹ 2,00,000
4. Cash Operating Expenses p.a. = Cash Outflow p.a.	₹ 1,20,000	₹ 1,80,000
5. Annuity Factor at 10% for 3 year and 2 years	0.9091 + 0.8264 + 0.7513 = 2.4868	0.9091 + 0.8264 = 1.7355
6. Equivalent Annual Investment = (1) ÷ (5)	₹ 2,41,274	₹ 2,30,481
7. Equivalent Annual Outflow/Cost (4) + (6)	Outflow = ₹ 3,61,274	₹ 4,10,481

Decision: Since Machine A has the least EAC (Equivalent Annual Costs), it may be selected.

Solution 59:

A firm is in need of a small vehicle

Selection of Investment Decision

Tax shield on Purchase of New vehicle			
Year	**WDV**	**Dep. @ 25%**	**Tax shield @ 30%**
1	1,50,000	37,500	11,250
2	1,12,500	28,125	8,437
3	84,375	21,094	6,328
4	63,281	15,820	4,746
5	47,461	11,865	3,560
6	35,596	8,899	2,670
7	26,697	6,674	2,002
8	20,023	5,006	1,502
9	15,017	3,754	1,126
10	11,263	2,816	845
11	8,447	Scrap value	

Tax shield on Purchase of Second hand vehicles

Year	WDV	Dep. @ 25%	Tax shield @ 30%
1	80,000	20,000	6,000
2	60,000	15,000	4,500
3	45,000	11,250	3,375
4	33,750	8,437	2,531
5	25,313	6,328	1,898
6	60,000	15,000	4,500
7	45,000	11,250	3,375
8	33,750	8,437	2,531
9	25,313	6,328	1,898
10	18,985	4,746	1,424

Calculation of PV of Net outflow of New Vehicle

Year	Cash OF/IF	PV Factor	PV of OF/IF
0	1,50,000	1	1,50,000
1	-11,250	0.892	-10,035
2	-8,437	0.797	-6,724
3	-6,328	0.711	-4,499
4	-4,746	0.635	-3,014
5	-3,560	0.567	-2,018
6	-2,670	0.506	-1,351
7	-2,002	0.452	-905

8	-1,502	0.403	-605
9	-1,126	0.36	-405
10	(845 + 8447)	0.322	-2,992
		PVNOF	1,17,452

Calculation of PV of Net outflow of Second hand Vehicles

Year	Cash OF/IF	PV Factor	PV of OF/IF
0	80,000	1	80,000
1	-6,000	0.892	-5,352
2	-4,500	0.797	-3,587
3	-3,375	0.711	-2,400
4	-2,531	0.635	-1,607
5	(60000 – 18985 – 1898) = 39,117	0.567	22,179
6	-4,500	0.506	-2,277
7	-3,375	0.452	-1,525
8	-2,531	0.403	-1,020
9	-1,898	0.36	-683
10	(1424 + 14239) = (15,663)	0.322	-5,043
		PVNOF	78,686

Advise: The PV of net outflow is low in case of buying second hand vehicles. Therefore, it is advisable to buy second hand vehicles.

Solution 60:

(i) Statement showing Evaluation of Mutually Exclusive Proposals (In ₹)

Particulars	Time	P.V. Factor	Service Part		Replace Part	
			Amount	P.V.	Amount	P.V
Cash Outflows:						
Cost of machinery	0	1	50,000	50,000	50,000	50,000
Service Cost	1	0.9091	10,000	9,091	....	....
Add: Replace part	2	0.8264	....	....	15,400	12,727
P.V. of cash outflows (A)				59,091		62,727
Cash Inflows:						
Cash inflows from operation		2.4869				
	1-3		18,000	44,764		
	1-4	3.1699			18,000	57,058
Scrap value of machine	3	0.7513	12,500	9,391		
	4	0.6830			9,000	6,147
P.V. of cash inflows (A)				54,155		63,205
N.P.V. (B) – (A)				(4,936)		478

Advise: Purchase machine & Replace the part at end of second year.

(ii) If the supplier gives a discount of ₹ 5,000 on purchase of machine (In ₹)

Proposals	Service Part	Replace Part
N.P.V.	64	5,478
Cumulative	2.4869	3.1699
Equivalent Annual N.P.V.	25.73	1,728

Advise: Purchase machine & Replace the part at end of second year.

Solution 61:

(a) Option I: Purchase Machinery and Service Part at the end of Year 2 and 4.

Net Present value of cash flow @ 12% per annum discount rate.

NPV (in ₹) = - 10,00,000 + 2,56,000 x (0.8928+0.7972+0.7118+0.6355+0.5674) – (1,00,000 x 0.7972+1,00,000 x 0.6355) + (76,000 x 0.5674)

= - 10,00,000 + (2,56,000 x 3.6047) – 1,43,270+43,122.4

= - 10,00,000 + 9,22,803.2 – 1,43,270+ 43,122.4

NPV = - 1,77,344.4

Since Net Present Value is negative; therefore, this option is not to be considered.

If Supplier gives a discount of ₹ 90,000, then:

NPV (in ₹) = + 90,000 - 1,77,344.4 = -87,344.4

In this case, Net Present Value is still negative; therefore, this option may not be advisable

Option II: Purchase Machinery and Replace Part at the end of Year 2.

NPV (in ₹)= - 10,00,000 + 2,56,000 x (0.8928+0.7972+0.7118+0.6355+0.5674) – (3,00,000 x 0.7118) + (1,86,000 x 0.5066+1,36,000 x 0.5066)

= - 10,00,000 + (2,56,000 x 3.6047) – 2,13,540+1,63,125.2

= - 10,00,000 + 9,22,803.2 – 2,13,540+1,63,125.2

NPV = - 1,27,611.6

Net Present Value is negative, the machinery should not be purchased.

If the Supplier gives a discount of ₹ 90,000, then:

NPV (in ₹) = 90,000 - 1,27,611.6 = - 37,611.6

In this case, Net Present Value is still negative; therefore, this option may not be advisable.

Decision: The Machinery should not be purchased as it will earn a negative NPV in both options of repair and replacement.

Solution 62:

Let the minimum labour savings required per annum be x.

Statement showing determination of minimum labour saving required per annum(In ₹)

Particulars	Time	PV Factor	Amount	PV
Cash Outflows:				
Cost of machine	0	1	80,000	80,000
				80,000
Cash Inflows:				
Saving in Raw Material Cost	1-7	4.564	8,000	36,512
Minimum labour	1-7	4.564	x	4.564x
				36,512 + 4.564x

80,000 = 36,512 + 4.564x

x = $\frac{43,488}{4.564}$ = ₹ 9,528

Maximum Bonus per annum = 4,472

Maximum percentage change in estimated labour savings that will render project unviable = $\frac{4,472}{14,000}$× 100 = 31.94%

Solution 63:

Evaluation of Alternatives:

Savings in disposing off the waste

Particulars	(₹)
Outflow (50,000 × ₹ 1)	50,000
Less: tax savings @ 50%	25,000
Net Outflow per year	25,000

Calculation of Annual Cash inflows in Processing of waste Material

Particulars	Amount (₹)	Amount (₹)
Sale value of waste (₹ 10 × 50,000 gallon)		5,00,000
Less: Variable processing cost (₹ 5 × 50,000 gallon)	2,50,000	
Less: Fixed processing cost	30,000	
Less: Advertisement cost	20,000	
Less: Depreciation	60,000	(3,60,000)
Earnings before tax (EBT)		1,40,000
Less: Tax @ 50%		(70,000)
Earnings after tax (EAT)		70,000
Add: Depreciation		60,000
Annual Cash inflows		1,30,000

Total Annual Benefits = Annual Cash inflows + Net savings (adjusting tax) in disposal cost

= ₹ 1,30,000 + ₹ 25,000 = ₹ 1,55,000

Calculation of Net Present Value

Year	Particulars	Amount (₹)
0	Investment in new equipment	(6,00,000)
1 to 10	Total Annual benefits × PVAF (10 years, 15%) ₹ 1,55,000 × 5.019	7,77,945
	Net Present Value	1,77,945

Recommendation: Processing of waste is a better option as it gives a positive Net Present Value.

Note- Research cost of ₹ 60,000 is not relevant for decision making as it is sunk cost.

Solution 64:

Computation of initial cash outlay (COF)

	(₹ In Lakhs)
Project Cost	240
Working Capital	30
	270

Calculation of Cash Inflows (CIF):

Years	1	2	3-5	6-8
Sales in units	60,000	80,000	1,40,000	1,20,000
Contribution (₹200 x 60% x No. of Units)	72,00,000	96,00,000	1,68,00,000	1,44,00,000
Less: Fixed Cost	(30,00,000)	(30,00,000)	(30,00,000)	(30,00,000)
Less: Advertisement	(50,00,000)	(25,00,000)	(10,00,000)	(5,00,000)
Less: Depreciation (2,40,00,000/8) = 3,00,000	(30,00,000)	(30,00,000)	(30,00,000)	(30,00,000)
Profit/Loss	(38,00,000)	11,00,000	98,00,000	79,00,000
Less: Tax @ 25%	Nil	(2,75,000)	(24,50,000)	(19,75,000)
Profit/loss after Tax	(38,00,000)	8,25,000	73,50,000	59,25,000
Add: Depreciation	30,00,000	30,00,000	30,00,000	30,00,000
Cash Inflow	(8,00,000)	38,25,000	1,03,50,000	89,25,000

(Note: Since variable cost is 40%, Contribution shall be 60% of sales)
Computation of PV of CIF

Year	CIF (₹)	PV Factor @ 10%	(₹)
1	(8,00,000)	0.909	(7,27,200)
2	38,25,000	0.826	31,59,450
3	1,03,50,000	0.751	77,72,850
4	1,03,50,000	0.683	70,69,050
5	1,03,50,000	0.621	64,27,350
6	89,25,000	0.564	50,33,700
7	89,25,000	0.513	45,78,525
8	89,25,000	0.467	55,68,975
Working Capital	30,00,000		
			3,88,82,700
	PV of COF		2,70,00,000
		NPV	1,18,82,700

Recommendation: Accept the project in view of positive NPV.

Solution 65:

Computation of initial cash outlay

Particulars	Amount (₹ in lakhs)
Equipment Cost (0)	120
Working Capital (0)	15
	135

Calculation of Cash Inflows

Years	1	2	3-5	6-8
Sales in units	80,000	1,20,000	3,00,000	2,00,000
	₹	₹	₹	₹
Contribution @ ₹ 60 p.u.	48,00,000	72,00,000	1,80,00,000	1,20,00,000
Fixed Cost	(16,00,000)	(16,00,000)	(16,00,000)	(16,00,000)
Advertisement	(30,00,000)	(15,00,000)	(10,00,000)	(4,00,000)
Depreciation	(15,00,000)	(15,00,000)	(16,50,000)	(16,50,000)
Profit/(Loss)	(13,00,000)	26,00,000	1,37,50,000	83,50,000
Tax @ 50%	(Nil)	(13,00,000)	(68,75,000)	(41,75,000)
Profit/(Loss) after tax	(13,00,000)	13,00,000	68,75,000	41,75,000
Add: Depreciation	15,00,000	15,00,000	16,50,000	16,50,000
Cash Inflow	2,00,000	28,00,000	85,25,000	58,25,000

Computation of PV of CIF

Year	CF (₹)	PV Factor @ 12%	₹
1	2,00,000	0.893	1,78,600
2	28,00,000	0.797	22,31,600
3	85,25,000	0.712	60,69,800
4	85,25,000	0.636	54,21,900
5	85,25,000	0.567	48,33,675
6	58,25,000	0.507	29,53,275
7	58,25,000	0.452	26,32,900
8	58,25,000	0.404	29,99,700
WC	15,00,000		
SV	1,00,000		
			2,73,21,450
	PV of Cash Outflow	1,35,00,000	
Additional Investment	= ₹ 10,00,000 × 0.797	7,97,000	(1,42,97,000)
		NPV	1,30,24,450

Recommendation: Accept the project in view of positive NPV.

Solution 66:

Workings:

(a) **Calculation of annual cash flow** (₹ in lakh)

Year	Sales	VC	FC	Dep.	Profit	Tax	PAT	Dep.	Cash inflow
1	172.80	103.68	36	43.75	(10.63)	-	-	43.75	33.12
2	259.20	155.52	36	43.75	23.93	3.99*	19.94	43.75	63.69
3	624.00	374.40	36	43.75	169.85	50.955	118.895	43.75	162.645
4-5	648.00	388.80	36	48.25	174.95	52.485	122.465	48.25	170.715
6-8	432.00	259.20	36	48.25	88.55	26.565	61.985	48.25	110.235

(b) **Calculation of Depreciation:**

- On initial equipment = $\frac{₹\ 350\ lakh}{8\ years}$ = 43.75 lakh
- On additional equipment = $\frac{(₹\ 25 - 2.5)\ lakh}{5\ years}$ = 4.5 lakh

(c) ***Calculation of tax in 2nd Year:**

	₹ in lakh
Profit for the year	23.93
Less: Set off of unabsorbed depreciation in 1st year	(10.63)
Taxable profit	13.30
Tax @30%	3.99

(d) **Calculation of Initial cash outflow**

	₹ in lakh
Cost of New Equipment	350
Add: Working Capital	40
Outflow	390

Calculation of NPV (₹ in lakh)

Year	Cash flows	PV factor @12%	PV of cash- flows	Remark
0	(390)	1.000	(390.00)	Initial equipment cost
1	33.12	0.893	29.57	
2	63.69	0.797	50.76	
3	162.645	0.712	115.80	
3	(25.00)	0.712	(17.80)	Additional equipment cost
4	170.715	0.636	108.57	
5	170.715	0.567	96.79	
6	110.235	0.507	55.89	
7	110.235	0.452	49.83	
8	110.235	0.404	44.53	
8	40.00	0.404	16.16	Release of working capital
Net Present Value			160.10	

Advise: Since the project has a positive NPV, therefore, it should be accepted.

Solution 67:

Project	Investment Required	Present value of Future Cash Flows	Net Present value
	₹	₹	₹
1	2,00,000	2,90,000	90,000
2	1,15,000	1,85,000	70,000
3	2,70,000	4,00,000	1,30,000
1 and 2	3,15,000	4,75,000	1,60,000

1 and 3	4,40,000	6,90,000	2,50,000
2 and 3	3,85,000	6,20,000	2,35,000
1, 2 and 3 (Refer Working note)	6,80,000*	9,10,000	2,30,000

Working Note:

(i) Total Investment required if all the three projects are undertaken simultaneously:

	(₹)
Project 1& 3	4,40,000
Project 2	1,15,000
Plant extension cost	1,25,000
Total	6,80,000

(ii) Total of Present value of Cash flows if all the three projects are undertaken simultaneously:

	(₹)
Project 2& 3	6,20,000
Project 1	2,90,000
Total	9,10,000

Projects 1 and 3 should be chosen, as they provide the highest net present value.

Solution 68:

Since the life span of each machine is different and time span exceeds the useful lives of each model, we shall use Equivalent Annual Cost method to decide which brand should be chosen.

(i) If machine is used for 20 years

(a) Residual value of machine of brand X

= [₹. 15,00,000 – (1 - 0.10)] - (₹. 15,00,000 × 0.06 × 14) = ₹. 90,000

(b) Residual value of machine of brand Y

= [₹. 10,00,000 – (1 - 0.40)] - (₹. 10,00,000 × 0.06 × 9) = ₹. 60,000

Present Value (PV) of cost if machine of brand X is purchased

Period	Cash Outflow (₹.)	PVF @ 12%	PV (₹.)
0	15,00,000	1.000	15,00,000
1-5	50,000	3.605	1,80,250
6-10	70,000	2.046	1,43,220
11-15	98,000	1.161	1,13,778
15	(90,000)	0.183	(16,470)
			19,20,778

PVAF for 1-15 years = 6.812

Equivalent Annual Cost = $\frac{₹.\ 19,20,778}{6.812}$ = ₹. 2,81,969.76

Present Value (PV) of cost if machine of brand Y is purchased

Period	Cash Outflow (₹.)	PVF @ 12%	PV (₹.)
0	10,00,000	1.000	10,00,000
1-5	70,000	3.605	2,52,350
6-10	1,15,000	2.046	2,35,290
10	(60,000)	0.322	(19,320)
			14,68,320

PVAF for 1-10 years = 5.651

Equivalent Annual Cost = $\frac{₹.\ 14,68,320}{5.651}$ = ₹. 2,59,833.66

Present Value (PV) of cost if machine of brand Y is taken on rent

Period	Cash Outflow (₹.)	PVF @ 12%	PV (₹.)
0	2,24,000	1.000	2,24,000
1-4	2,25,000	3.038	6,83,550
5-9	2,70,000	2.291	6,18,570
			15,26,120

PVAF for 1-10 years = 5.651

Equivalent Annual Cost = $\frac{₹.\ 15,26,120}{5.651}$ = ₹. 2,70,061.94

Decision: Since Equivalent Annual Cash Outflow is least in case of purchase of Machine of brand Y the same should be purchased.

(ii) If machine is used for 5 years

a) Scrap value of machine of brand X

= [₹. 15,00,000 – (1 - 0.10)] - (₹. 15,00,000 × 0.06 × 4) = ₹. 9,90,000

b) Scrap value of machine of brand Y

= [₹. 10,00,000 – (1 - 0.40)] - (₹. 10,00,000 × 0.06 × 4) = ₹. 3,60,000

Present Value (PV) of cost if machine of brand X is purchased

Period	Cash Outflow (₹.)	PVF @ 12%	PV (₹.)
0	15,00,000	1.000	15,00,000
1-5	50,000	3.605	1,80,250
5	(9,90,000)	0.567	(5,61,330)
			11,18,920

Present Value (PV) of cost if machine of brand Y is purchased

Period	Cash Outflow (₹.)	PVF @ 12%	PV (₹.)
0	10,00,000	1.000	10,00,000
1-5	70,000	3.605	2,52,350
5	(3,60,000)	0.567	(2,04,120)
			10,48,230

Present Value (PV) of cost if machine of brand Y is taken on rent

Period	Cash Outflow (₹.)	PVF @ 12%	PV (₹.)
0	2,24,000	1.000	2,24,000
1-4	2,25,000	3.038	6,83,550
5	1,10,000*	0.567	62,370
			9,69,920

* [₹. 2,20,000 - (₹. 22,000 × 5) = ₹. 1,10,000]

Decision: Since Cash Outflow is least in case of rent of Machine of brand Y the same should be taken on rent.

Solution 69:

Calculation of Net Cash flows

Contribution = (₹ 6 – ₹ 3) x 1,00,000 units = ₹ 3,00,000

Fixed costs (excluding depreciation) = ₹ 1,00,000

Year	Capital (₹)	Contribution (₹)	Fixed costs (₹)	Advertisement/ Maintenance expenses (₹)	Net cash flow (₹)
0	(2,50,000)				(2,50,000)
1		3,00,000	(1,00,000)	(20,000)	1,80,000
2		3,00,000	(1,00,000)		2,00,000
3		3,00,000	(1,00,000)		2,00,000
4		3,00,000	(1,00,000)		2,00,000
5		3,00,000	(1,00,000)	(30,000)	1,70,000
6		3,00,000	(1,00,000)		2,00,000
7		3,00,000	(1,00,000)		2,00,000
8		3,00,000	(1,00,000)		2,00,000

Calculation of Net Present Value

Year	Net cash flow (₹)	12% discount factor	Present value (₹)
0	(2,50,000)	1.000	(2,50,000)
1	1,80,000	0.893	1,60,740
2	2,00,000	0.797	1,59,400
3	2,00,000	0.712	1,42,400
4	2,00,000	0.636	1,27,200
5	1,70,000	0.567	96,390
6	2,00,000	0.507	1,01,400
7	2,00,000	0.452	90,400
8	2,00,000	0.404	80,800
			7,08,730

Advise: CK Ltd. should buy the new machine, as the net present value of the proposal is positive i.e ₹ 7,08,730.

Solution 70:

(i) Optimizing returns when projects are independent and divisible.

Computation of NPVs per Re. 1 of Investment and Ranking of the Projects

Project	Investment	NPV	NPV per Re. 1 invested	Ranking
C	40,000	20,000	0.50	1
D	1,00,000	35,000	0.35	3
E	50,000	24,000	0.48	2
F	60,000	18,000	0.30	4

Building up of a Package of Projects based on their Rankings

Project	Investment	NPV
C	40,000	20,000
E	50,000	24,000
D (1/10th of Project)	10,000	3,500
Total	1,00,000	47,500

The company would be well advised to invest in Projects C, E and D (1/10th) and reject Project F to optimise return within the amount of ₹ 1,00,000 available for investment.

(ii) Optimizing returns when projects are indivisible.

Package of Project	Investment	Total NPV
C and E	90,000 (40,000 + 50,000)	44,000 (20,000 + 24,000)
C and F	1,00,000 (40,000 + 60,000)	38,000 (20,000 + 18,000)
Only D	1,00,000	35,000

The company would be well advised to invest in Projects C and E to optimise return within the amount of ₹ 1,00,000 available for investment.

Solution 71:

Statement showing ranking of projects on the basis of Profitability Index

Project	Amount (₹)	P.I.	Rank
1	3,00,000	1.22	1
2	1,50,000	0.95	5
3	3,50,000	1.20	2
4	4,50,000	1.18	3
5	2,00,000	1.20	2
6	4,00,000	1.05	4

Assuming that projects are indivisible and there is no alternative use of the money allocated for capital budgeting on the basis of P.I the S Ltd. is advised to undertake investment in projects 1, 3 and 5.

However, among the alternative projects the allocation should be made to the projects which add the most to the shareholders wealth. The NPV method, by its definition, will always select such projects.

Statement showing NPV of the projects

Project (i)	Amount (₹) (ii)	P.I. (iii)	Cash inflows of Project (₹) (iv) = [(ii)× (iii)]	NPV of project (₹) (v) = [(iv) – (ii)]
1	3,00,000	1.22	3,66,000	66,000
2	1,50,000	0.95	1,42,500	(-) 7,500
3	3,50,000	1.20	4,20,000	70,000
4	4,50,000	1.18	5,31,000	81,000
5	2,00,000	1.20	2,40,000	40,000
6	4,00,000	1.05	4,20,000	20,000

The allocation of funds to the projects 1, 3 and 5 (as selected above on the basis of P.I.) will give N.P.V. of ₹ 1,76,000 and ₹ 1,50,000 will remain unspent.

However, the N.P.V. of the projects 3, 4 and 5 is ₹1,91,000 which is more than the N.P.V. of projects 1, 3 and 5. Further, by undertaking projects 3, 4 and 5 no money will remain unspent. Therefore, S Ltd. is advised to undertake investments in projects 3, 4 and 5.

Solution 72:

Computation of NPV of optimum project mix **(In ₹)**

Projects	Initial Investment	NPV
4	13,00,000	7,00,000
3	7,00,000	4,40,000
1	8,00,000	2,00,000
Uninvested	2,00,000	(17,313)
	30,00,000	13,22,687

Working Notes:

Computation of NPV in various projects (In ₹)

Projects	NPV
1	10,00,000 – 8,00,000 = 2,00,000
2	19,00,000 – 15,00,000 = 4,00,000
3	11,40,000 – 7,00,000 = 4,40,000
4	20,00,000 – 13,00,000 = 7,00,000

Computation of NPV ofUninvested Amount(In ₹)

Particulars	Time	P.V. Factor	Amount	P.V.
Cash Outflows:	0	1	2,00,000	2,00,000
P.V. of Cash Outflows				2,00,000
Cash Inflows:	5	0.567	(2,00,000 × 1.611) 3,22,200	1,82,687
P.V.C.I				1,82,687
NPV				(17,313)

Solution 73:

Computation of NPVs per Re. 1 of Investment and Ranking of the Projects

Project	Investment (₹ '000)	NPV @ 15% (₹ '000)	NPV per ₹ 1invested	Ranking
A	(50)	15.4	0.31	5
B	(40)	18.7	0.47	2
C	(25)	10.1	0.40	3
D	(30)	11.2	0.37	4
E	(35)	19.3	0.55	1

Building up of a Programme of Projects based on their Rankings

Project	Investment (₹ '000)	NPV @ 15% (₹ '000)
E	(35)	19.3
B	(40)	18.7
C	(25)	10.1

D	(20)	7.5	(2/3 of project total)
	120	55.6	

Thus project A should be rejected and only two-third of Project D is undertaken.
If the projects are not divisible then other combinations can be examined as:

	Investment(₹'000)	NPV @ 15%(₹ '000)
E+B+C	100	48.1
E+B+D	105	49.2

In this case E + B + D would be preferable as it provides a higher NPV despite D ranking lower than C.

Solution 74:

Option I: Cost of travel, in case Video Conferencing facility is not provided
Total Trip = No. of Locations × No. of Persons × No. of Trips per Person = 7×2×2 = 28 Trips
Total Travel Cost (including air fare, hotel accommodation and meals) (28 trips × ₹ 27,000 per trip)
= ₹ 7,56,000

Option II: Video Conferencing Facility is provided by Installation of Own Equipment at Different Locations
Cost of Equipment at each location (₹ 8,25,000 × 8 locations) = ₹ 66,00,000
Economic life of Machines (5 years). Annual depreciation (66,00,000/5) = ₹ 13,20,000
Annual transmission cost (48 hrs. transmission × 8 locations × ₹ 300 per hour) = ₹ 1,15,200
Annual cost of operation (13,20,000 + 1,15,200) = ₹ 14,35,200

Option III: Engaging Video Conferencing Facility on Rental Basis
Rental cost (48 hrs. × 8 location × ₹ 1,500 per hr) = ₹ 5,76,000 Telephone cost (48 hrs.× 8 locations × ₹ 400 per hr.) = ₹ 1,53,600
Total rental cost of equipment (5,76,000 + 1,53,600) = ₹ 7,29,600

Analysis: The annual cash outflow is minimum, if video conferencing facility is engaged on rental basis. Therefore, Option III is suggested.

Solution 75:

Net Present Value (NPV) of Projects:

Year	Cash Inflows Project A (₹)	Cash Inflows Project B (₹)	Present Value Factor @ 10%	PV of Project A (₹)	PV of Project B (₹)
0	(1,00,000)	(3,00,000)	1.000	(1,00,000)	(3,00,000)
1	50,000	1,40,000	0.909	45,450	1,27,260
2	60,000	1,90,000	0.826	49,560	1,56,940
3	40,000	1,00,000	0.751	30,040	75,100
				25,050	59,300

Internal Rate of Returns (IRR) of projects:

Since by discounting cash flows at 10% we are getting values very far from zero. Therefore, let us discount cash flows using 20% discounting rate.

Year	Cash Inflows Project A (₹)	Cash Inflows Project B (₹)	Present Value Factor @ 20%	PV of Project A (₹)	PV of Project B (₹)
0	(1,00,000)	(3,00,000)	1.000	(1,00,000)	(3,00,000)
1	50,000	1,40,000	0.833	41,650	1,16,620
2	60,000	1,90,000	0.694	41,640	1,31,860
3	40,000	1,00,000	0.579	23,160	57,900
				6,450	6,380

Since by discounting cash flows at 20% we are getting values far from zero. Therefore, let us discount cash flows using 25% discounting rate.

Year	Cash Inflows Project A (₹)	Cash Inflows Project B (₹)	Present Value Factor @25%	PV of Project A (₹)	PV of Project B (₹)
0	(1,00,000)	(3,00,000)	1.000	(1,00,000)	(3,00,000)
1	50,000	1,40,000	0.800	40,000	1,12,000
2	60,000	1,90,000	0.640	38,400	1,21,600
3	40,000	1,00,000	0.512	20,480	51,200

				(1,120)	(15,200)

The internal rate of return is, thus, more than 20% but less than 25%. The exact rate can be obtained by interpolation:

$IRR_A = 20\% + \frac{6,450}{6,450 - (1,120)} \times (25\% - 20\%) = 20\% + \frac{6,450}{7,570} \times 5\% = 24.26\%$

$IRR_B = 20\% + \frac{6,380}{6,380 - (15,200)} \times (25\% - 20\%) = 20\% + \frac{6,380}{21,580} \times 5\% = 21.48\%$

Overall Position

	Project A	Project B
NPV @ 10%	25,050	59,300
IRR	24.26%	21.48%

Thus there is contradiction in ranking by two methods.