2. INVESTMENT DECISIONS

ASSIGNMENT SOLUTIONS

PROBLEM NO: 1

Calculation of cash flows i.e. CFAT

i) If there is no Depreciation

Particulars	Amount (Rs. in Cr.)
PBDT (30 Cr – 25 Cr)	5
Less: Depreciation	Nil
PBT	5
Less: Tax @ 30%	(1.5)
PAT	3.5
Add: Depreciation	Nil
CFAT	3.5

∴ CFAT = 3.5 Cr

ii) If there is a Depreciation of Rs.1.5 Cr

Particulars	Amount (Rs. in Cr.)
PBDT	5
Less: Depreciation	(1.5)
PBT	3.5
Less: Tax @ 30%	(1.05)
PAT	2.45
Add: Depreciation	1.50
CFAT	3.95

∴ CFAT = 3.95 Cr

PROBLEM NO: 2

Calculation of ARR

Particulars	Machine A (Rs.)	Machine B (Rs.)
i) Depreciation	$9,600\left[\frac{50000-2000}{5\,yrs}\right.$	$9,600\left[\frac{50000-2000}{5\,yrs}\right.$
ii) Avg. Investment $\left[\frac{1}{2}(cost-sv)+sv+w.cap\right]$	30,000 $\left[\frac{1}{2}(50000-2000)+2000+4000\right]$	40,000 $\left[\frac{1}{2}(50000-2000)+2000+14000\right]$
iii) Avg. PAT	$15,000\left[\frac{5k+10k+15k+20k+25k}{5}\right.$	$15,000\,\frac{PVCOF}{PVAF(2,9\%)}$
iv) ARR (iii ÷ ii)	$50\%\left[\frac{15000}{30000}x100\right.$	$37.5\%\left[\frac{15000}{40000}x100\right.$

PROBLEM NO: 3

Working notes 1:

Calculation of depreciation:

Cost of the machine	5,00,000
Salvage value	-
Depreciation $\frac{Cost\ of\ the\ project-Salvage\ value}{Estimated\ life}$	$\frac{5,00,000-Nil}{5\,years}=1,00,000$

Working notes 2:

Estimation of Cash flow after Tax

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Cash flow before Depreciation & tax	1,00,000	1,00,000	1,50,000	1,50,000	2,50,000
Less: Depreciation	1,00,000	1,00,000	1,00,000	1,00,000	1,00,000
Cash flow before tax	-	-	50,000	50,000	1,50,000
Less: Tax @55%	-	-	27,500	27500	82500
Cash flow after tax	-	-	22500	22500	67500
Add: Depreciation	1,00,000	1,00,000	1,00,000	1,00,000	1,00,000
CFAT	1,00,000	1,00,000	1,22,500	1,22,500	1,67,500

Estimation of payback period

Year	CFET(W.N:2)	Cumulative CFAT
1	1,00,000	1,00,000
2	1,00,000	2,00,000
3	1,22,500	3,22,500
4	1,22,500	4,45,000
5	1,67,500	6,12,500

$$\text{Payback period} = \text{Covered Year} + \frac{\text{Uncovered Amount}}{\text{Next year CFAT}} = 4^{th}\text{ year} + \frac{55,000}{1,67,500} = 4.32\text{years}$$

PROBLEM NO: 4

a) Calculation of payback period

	Cash Flows (Rs. 000)					
Project	C_0	C_1	C_2	C_3	C_4	**Payback period**
A	-1000	+600	+200	+200	+1000	3 year
B	-1000	+200	+200	+600	+1000	3 year
C	-300	+100	+100	+100	+600	3 year
D	-300	0	0	+300	+600	3 year

b) If Standard payback period is 2 Years: since actual payback period i.e. (3 years) is more than the standard payback period i.e. (2 years), we should reject all the three projects.

c) If payback period is 3 Years: since actual payback period i.e. (3 years) is equal to the standard payback period i.e. (3 years), we may accept or reject the project.

PROBLEM NO: 5

Year	Net Cash Flows	PVIF @ 10%	Discounted Cash Flows
0	(1,00,000)	1.000	(1,00,000)
1	55,000	0.909	49,995
2	80,000	0.826	66,080
3	15,000	0.751	11,265
Net Present Value			**27,340**

Recommendation: Since the net present value of the project is positive, the company should accept the project.

PROBLEM NO: 6

Calculation NPV project X, y and Z.

We know that, At NPV: Present value of Cash Outflows = Present value of Cash Inflows

1. NPV for Project X = (3,305 x 0.797) - 2,500 = 134
2. NPV for Project Y = 1,540 x 1.69 - 2,500 = 102.6
3. NPV for Project Z = 2,875 x 0.893 - 2,500 = 66.9

Decision Making:

If the projects are mutually independent, accept all the projects since all the projects sum up to all one.

If the projects are mutually exclusive, accept the project which gives the highest positive NPV.

PROBLEM NO: 7

Step 1: Calculation of Present Value of Cash Outflows **(Rs. In Lakhs)**

Particulars		Amount
Cost of windmill		300.00
Cost of land		15.00
		315.00
Less: Subsidy from Govt. receivable at the end of 1st year	15	
Present value thereof [15 x PVF (15%, 1y)] = 15 x 0.870		13.05
Present Value of Net Cash Outflows		301.95

Step 2: Calculation of Present Value of Operating Cash Inflows

Particulars	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8	Y_9	Y_{10}
a) Lakhs of units generated (Note 1)	24	24	24	24	24	24	24	24	24	24
b) Cost per unit (in Rs.)	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.25	4.75	5.25
c) Savings in Electricity Cost (a x b) (in Lakhs)	54	60	66	72	78	84	90	102	114	126
d) Maintenance Cost	4	6	8	10	12	14	16	18	20	22
e) Depreciation	300	-	-	-	-	-	-	-	-	-
f) PBT (c-d-e) (Loss)	(250)	54	58	62	66	70	74	84	94	104
g) Tax (Tax Shield) @ 50%	(125)	27	29	31	33	35	37	42	47	52
h) PAT / (Loss) (f-g)	(125)	27	29	31	33	35	37	42	47	52
i) CFAT (h + e)	175	27	29	31	33	35	37	42	47	52
j) PVF @ 15%	0.87	0.756	0.658	0.572	0.497	0.432	0.376	0.327	0.284	0.247
k) Present Value (i x j)	152.25	20.41	19.08	17.73	16.40	15.12	13.91	13.73	13.35	12.84

Therefore, Present Value of Operating Cash Inflows = 294.82 Lakhs

Step 3: Calculation of Present Value of Terminal Cash Inflows (At the end of the project)

Particulars	Land	Wind Mill
a) Gross Sale Proceeds	60	0
b) WDV / Book Value	15	0
c) Capital Gains (a - b)	45	0
d) Capital Gains tax @ 50% (Note 3)	0	0
e) Net Sale Proceeds (NSP) (a – d)	60	0
∴ Terminal Cash Inflows ⟶	60 Lakhs	

Net Sale Proceeds on Sale of Assets = 60 Lakhs

Present value thereof = 60 x PVF (15%, 10y) = 60 x 0.247 = 14.82 Lakhs

Step - 4: Calculation of NPV

NPV = PV of cash inflows - PV of cash outflows

= PV of Operating Cash Inflows + PV of Terminal Cash Inflows – PV of cash outflows.

= 294.82 + 14.82 - 301.95 = 7.69 Lakhs

Conclusion: Since NPV is positive it is beneficial for the company to accept the proposal.

Note 1: No. of units of electricity generated = 25,00,000

Less: Electricity freely supplied to State Govt. @ 4% = 1,00,000

No. of units of Electricity that can be utilised = 24,00,000 units

Note 2: It is given in the problem that cost of windmill has to be written off 100% in the first year for income tax purposes.

Note 3: It is given that tax on capital profit should be ignored. Therefore, Gross Sale Proceeds will be equal to Net Sale Proceeds.

Assumptions:

- Cash flows are assumed to accrue at the end of each year.
- Interim cash inflows at the end of each year are assumed to be reinvested at the rate of cost of capital.
- Cash flows given in the problem are assumed to be certain.

PROBLEM NO: 8

ABC Ltd. Company has two options to shift the stores department.

1. Shifting as on today.
2. Shifting after an year.

a) NPV for shifting as on today:

Year	Cash flow	PVF @ 15%	Present Value
0	- 250	1	- 250
1	160	0.870	139.2
2	170	0.756	128.5
NPV			17.7

b) NPV for shifting after an year:

Year	Cash flow	PVF @ 15%	Present Value
1	- 350	0.870	- 304.5
2	200	0.756	151.2
3	250	0.658	164.5
NPV			11.2

Since, both options are mutually exclusive; it is advisable to shift Highest NPV value i.e. shifting as on today

PROBLEM NO: 9

W.N. 1: Calculation of depreciation per annum

$$\text{Depreciation p.a.} = \left(\frac{\text{Cost - Scrap Value}}{\text{Life}}\right) = \frac{80{,}000 - 0}{5} = \text{Rs.16,000 p.a.}$$

Calculation of NPV using Incremental approach

Step 1: Calculation of Present Value of Cash Outflows:

Particulars	Amount
Investment in new equipment	80,000
Additional working capital	1,50,000
Total	2,30,000

Step 2: Calculation of Present Value of Operating Cash Inflows:

Particulars	Amount Rs.	Amount Rs.
Incremental net cash in flow		1,00,000
Less: additional wages	40,000	
Depreciation (W.N.1)	16,000	56,000
Incremental PBT		44,000
Less: Tax @ 40 %		17,600
Incremental PAT		26,400
Add: Depreciation		16,000
Incremental CFAT p.a.		42,400

Therefore, Present Value of Operating Cash Inflows = 42,000 X PVAF (13%,5)

= 42,400 X 3.517 = 1,49,120

Step 3: Present Value of Terminal Cash Inflows =

GSP or NSP on sale of initial equipment = 0

Recovery of additional working capital = 1,50,000

1,50,000

PV there off = 1,50,000 x PVF (13%, 5) = 1,50,000 X 0.543 = Rs. 81,450

Step 4: Calculation of NPV

NPV = PV of cash inflows – PV of cash outflows

= PV of Operating Cash Inflows + PV of Terminal Cash Inflows - PV of cash outflows.

= 1,49,120 + 81,450 - 2,30,000 = Rs.570

Conclusion: Since NPV is positive it is advisable to accept.

PROBLEM NO: 10

a) Calculation of NPV:

Step 1: Calculation of Present Value of Cash Outflows:

Particulars	Amount
Cost of machinery	4,00,000
Present Value of Cash Outflows	4,00,000

Step 2: Calculation of Present Value of Operating Cash Inflows:

Particulars	Amount
a) Sales volume	40,000 units
b) Contribution per unit (10-6)	Rs.4
c) Total contribution (a x b)	1,60,000
d) Fixed cost	20,000
e) CFAT (c-d)	1,40,000 p.a

PV thereof = 1,40,000 X PVAF (15%,6) = 1,40,000 X 3.784 = 5,29,760

Step-3: Present Value of Terminal Cash Inflows

G.S.P/N.S.P on sale of machinery = 20,000

PV thereof = 20,000 X PVF (15%,6) = 20,000 X 0.432 = 8,640

Step-4: Calculation of NPV

NPV = PV of cash inflows – PV of cash outflows

= PV of Operating Cash Inflows +PV of Terminal Cash Inflows - PV of cash outflows.

= 5,29,760+8,640-4,00,000 = 1,38,400

Conclusion: Since NPV is positive it is advisable to accept the project.

b) Let, x represents the sale volume required to justify the project. The project is acceptable if NPV is at least equal to zero

Step 1: same as above – 4,00,000.

Step 2: Present Value of operating cash inflows

Particulars	Amount (Rs.)
a) Sales volume	X unit
b) Contribution per unit (10 – 6)	4
c) Total contribution	4X
d) Fixed cost	20,000
e) CFAT (c-d)	4X-20,000

Present value thereof = (4X – 20,000) * PVAF (15%, 6 years) = (4X – 20,000) *3.784

Step 3: same as above - 8,640

Step 4: Finding the value of X

Since NPV is '0' then present value of cash inflows = present value of cash outflows present value of operating cash inflows + present value of terminal cash inflows = present value of cash out flows

(4X – 20,000) * 3.784 + 8,640 = 4,00,000

(4X – 20,000) = 1,03,424

4X = 1,23,424

X = 30,856 units p.a.

PROBLEM NO: 11

W.N - 1: Calculation of depreciation per annum

Cost of Machinery	2,50,000
Less: Salvage value	30,000
Depreciable amount	2,20,000

Sum of the years digits = 1 + 2 + 3 + …….. + 10 = 55.

Dep. for 1st year = $\frac{2,20,000}{55} \times 10$ = Rs.40,000 2nd year = $\frac{2,20,000}{55} \times 9$ = Rs.36,000

3rd year = $\frac{2,20,000}{55} \times 8$ = Rs. 32,000 4th year = $\frac{2,20,000}{55} \times 7$ = Rs. 8,000

5th year = $\frac{2,20,000}{55} \times 6$ = Rs.24,000

W.D.V at the end of 5th year = Cost - depreciation = 2,50,000 – 1,60,000 = Rs. 90,000

Book value of machine after capital expenditure = 90,000 + 60,000 = Rs. 1,50,000

Depreciable amount from 6th to 10th year = 1,50,000 - 30,000 = Rs. 1,20,000

Sum of the years digits = 1 + 2 + 3 + 4 + 5 = 15

Dep. for 6th year = $\frac{1,20,000}{15} \times 5$ = Rs. 40,000 7th year = $\frac{1,20,000}{15} \times 4$ = Rs. 32,000

8th year = $\frac{1,20,000}{15} \times 3$ = Rs. 24,000 9th year = $\frac{1,20,000}{15} \times 2$ = Rs. 16,000

10th year = $\frac{1,20,000}{15} \times 1$ = Rs. 8,000

Calculation of NPV

Step-1: Calculation of Present Value of Cash Outflows

Particulars	Amount
Cost of Machinery	2,50,000
Add: Working capital	50,000
Add: Cost of Additional equipment [60,000 x PVF (20%, 5y)]	24,120
Present value of Cash Outflows	**3,24,120**

Step-2: Calculation of Present Value of Operating Cash Inflows. **(Rs. in Lakhs)**

Particulars	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8	Y_9	Y_{10}
PBDT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Less: Dep.(W.N-1)	0.4	0.36	0.32	0.28	0.24	0.40	0.32	0.24	0.16	0.08
P.B.T	0.6 L	0.64	0.68	0.72	0.76	0.60	0.68	0.76	0.84	0.92
Less: Tax @ 40%	0.24 L	0.256	0.272	0.288	0.304	0.24	0.272	0.304	0.336	0.368
P.A.T	0.36	0.384	0.408	0.432	0.456	0.36	0.408	0.456	0.504	0.552

Add: Depreciation	0.4	0.36	0.32	0.28	0.24	0.40	0.32	0.24	0.16	0.08
C.F.A.T.	0.76	0.744	0.728	0.712	0.696	0.76	0.728	0.696	0.664	0.632
X P.V.F (20%, n)	0.833	0.694	0.579	0.482	0.402	0.335	0.279	0.233	0.194	0.162
Present Value	0.634	0.516	0.422	0.343	0.279	0.255	0.203	0.162	0.128	0.102

Therefore, Present Value of operating cash inflows = Rs.3,04,498

Step-3: Calculation of Present Value of Terminal Cash Inflows (At the end of the project)

Particulars	Amount
G.S.P/N.S.P on sale of machinery	30,000
Add: Recovery of working capital	50,000
Total of Terminal Cash Inflows	**80,000**

Present Value thereof = 80,000 X PVF (20%, 10y) = 80,000 X 0.162 = Rs.12,960

Step-4: Calculation of NPV

NPV = PV of cash inflows – PV of cash outflows

= PV of Operating Cash Inflows + PV of Terminal Cash Inflows – PV of Cash Outflows

= 3,04,498 + 12,960 – 3,24,120 = - Rs. 6662

Conclusion: Since NPV is negative it is not advisable for the company to accept the project.

Assumptions:

- Cash flows are assumed to accrue at the end of each year.
- Interim cash inflows at the end of each year are assumed to be reinvested at the rate of cost of capital.

Cash flows given in the problem are assumed to be certain.

PROBLEM NO: 12

A. Computation of Differential Cash Flow

			Amount (Rs.)
	Plant A	**Plant B**	**Differential Cash Outflow**
Direct Labour Cost:			
1st shift	30,00,000	15,00,000	(15,00,000)
2nd shift		19,00,000	19,00,000
Overhead	5,00,000	4,20,000	(80,000)
Net Saving for using Plant A			3,20,000

Present value of net saving of (Rs. 3,20,000 × 6.1446) = Rs. 19,66,272 for Plant A @ 10% (cost of capital).

B. Additional Cash Outlay for Plant A over Plant B

	Rs.
Cost of Plant A	60,00,000
Cost of Plant B	44,00,000
Additional Outlay for using Plant A	16,00,000

Analysis: The net saving for the company in choosing Plant A = Rs. 19,66,272 – Rs. 16,00,000 = Rs. 3,66,272. Hence, Plant A should be implemented.

PROBLEM NO: 13

Step 1: Calculation of Depreciation

Particulars	Y1 to Y2	Y3 To Y8
Depreciation on initial equipment	17.5L $\left[\frac{140-0}{8}\right]$	17.5L
Depreciation on additional equipment $\left[\frac{10-1}{6}\right]$	-	1.5 L
Total Depreciation	17.5L	19.0L

Step 2 Calculation of P.V of initial Cash Outflows

Particulars	Amount (Rs. in lakhs)
Cost of initial equipment	140
Less: Subsidy from Government	(20)
	120
Add: P.V of Cost additional equipment at the end of 2nd year (10 x 0.797)	7.97
Add: Invest in Working Capital	15.00
Total initial Cash Outflows	142.97

P.V thereof = 142.97

Step 3 P.V of Operating Cash inflows

Particulars	Y1	Y2	Y3 to Y5	Y6 to Y8
Sales units	80,000	1,20,000	3,00,000	2,00,000
Contribution per unit (100-40)	Rs.60	Rs.60	Rs.60	Rs.60
Total Contribution (Rs.)	48,00,000	72,00,000	1,80,00,000	1,20,00,000
Less: Fixed Cost (Rs.)	(16,00,000)	(16,00,000)	(16,00,000)	(16,00,000)
Adv. Cost (Rs.)	(30,00,000)	(15,00,000)	(10,00,000)	(4,00,000)
PBDT (Rs.)	2,00,000	41,00,000	1,54,00,000	1,00,00,000
Less: Depreciation (Rs.)	(17,50,000)	(17,50,000)	(19,00,000)	(19,00,000)
Loss/PBT (Rs.)	(15,50,000)	23,50,000	1,35,00,000	81,00,000
Less: (Tax @50%) / Tax Shield (Rs.)	7,75,000	11,75,000	67,50,000	40,50,000
(Loss)/PAT (Rs.)	(7,75,000)	11,75,000	67,50,000	40,50,000
Add: Depreciation (Rs.)	17,50,000	17,50,000	19,00,000	19,00,000
CFAT (Rs.)	9,75,000	29,25,000	86,50,000	59,50,000
PVF @ 12%	0.893	0.797	1.915	1.363
Present values (Rs.)	8,70,675	23,31,225	1,65,64,750	81,09,850

P.V of Operating Cash inflows = Rs.2,78,76,500

Step 4: P.V of Terminal Cash inflows

Particulars	Amount (Rs. in lakhs)
NSP on sale of initial equipment	0.00
NSP on sale of additional equipment	1.00
Recovery of Working Capital	15.00
Total Terminal CIFs	16.00

P.V thereof = Rs.16,00,000 x 0.404 = Rs.6,46,400

Step 5: Calculation of NPV

NPV = PV of CIFs – PV of COFs

= Rs. 2,78,76,500 + Rs. 6,46,400 - Rs. 1,42,97,000 = Rs.1,42,25,900.

PROBLEM NO: 14

Computation of initial cash outlay:

	(Rs. In Lakhs)
Equipment cost	120
Additional equipment cost purchased at the end of the 2nd year (10 lacs x 0.797)	7.97
Working capital	15
PV. Of Cash outflows	142.97

Calculation of Cash Inflows:

Years	1	2	3-5	6-8
a) Sales in units	80,000	1,20,000	3,00,000	2,00,000
	(Rs.)	**(Rs.)**	**(Rs.)**	**(Rs.)**
b) Contribution @Rs. 60 p.u.	48,00,000	72,00,000	1,80,00,000	1,20,00,000

c) Fixed cost	16,00,000	16,00,000	16,00,000	16,00,000
d) Advertisement	30,00,000	15,00,000	10,00,000	4,00,000
e) 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	58,25000

Computation of PV of cash outflow

Year	Cash Inflow (Rs.)	PV factor @ 12%	(Rs.)
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	23,53,300
Working Capital	1500,000	0.404	6,06,000
Scrap Value	1,00,000	0.404	40,400
(A)			2,73,21,450
Cash outflow (B)			1,42,97,000
Net Present Value (NPV) (A-B)			Rs.1,30,24,450

Recommendation: Accept the project in view of positive NPV

PROBLEM NO: 15

Advise to the Hospital Management

Determination of Cash inflows

Sales Revenue	40,000
Less: Operating Cost	7,500
	32,500
Less: Depreciation (80,000 – 6,000)/8	9,250
Net Income	23,250
Tax @ 30%	6,975
Earnings after Tax (EAT)	16,275
Add: Depreciation	9,250
Cash inflow after tax per annum	25,525
Less: Loss of Commission Income	12,000
Net Cash inflow after tax per annum	13,525
In 8th Year :	
New Cash inflow after tax	13,525
Add: Salvage Value of Machine	6,000
Net Cash inflow in year 8	19,525

Calculation of Net Present Value (NPV)

Year	CFAT	PV Factor @10%	Present Value of Cash inflows
1 to 7	13,525	4.867	65,826.18
8	19,525	0.467	9,118.18
			74,944.36
Less: Cash Outflows			80,000.00
	NPV		(5,055.64)

Profitability Index = Sum of discounted cash inflows / Present value of cash outflows = 74,944.36 / 80,000 = 0.937

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

Note: Since the tax rate is not mentioned in the question, therefore, it is assumed to be 30 percent in the given solution.

PROBLEM NO: 16

From the given information,

Annual Cash inflows = 11,200

P.V of Cash flows = 36,000

No. of yrs. = 5yrs

IRR = ?

P.V of Initial cash outflow = Annual cash inflow x PVAF (nyrs r %)

Rs.36,000 = 11,200 x PVAF (5yrs r%)

PVAF = 36,000/11,200 = 3.2143

Trace this value against 5 yrs. in PVAF Table

IRR = 16% (Approx.)

PROBLEM NO: 17

i) Calculation of IRR for Project I

From the given information

Particulars	Amount (Rs.)
Present Value	25000
Future Value	30000
No. of yrs.	1 yr.
R	?
FV	PV x FVF (nyrs r %)
30,000	25,000 x FVF (1 yr., r %)
FVF	30,000/25,000
	1.2

Trace this value against 1 yrs. in FVF Table, r = 20% (Approx.)

ii) Project II

Particulars	Amount (Rs.)
Present Value	25,000
Future Value	43,750
No. of yrs.	4 yrs.
R	?
43750	25000 x FVF (4yr r %)
FVF	43,750/25,000
	1.75

Trace this Value against 4 yrs. in FVF Table, r = 15 % (Approx.)

PROBLEM NO: 18

i) Project A

		NPV at 1st guess rate 11%		NPV at 2nd guess rate12%	
Year	CFS (Rs.)	PVF @ 11%	P. values (Rs.)	PVF @ 12%	P. values (Rs.)
0	(11,000)	1	(11,000)	1	(11,000)
1	6,000	0.901	5,406	0.893	5,358
2	2,000	0.812	1,624	0.797	1,594

3	1,000	0.731	731	0.712	712
4	5,000	0.659	3,295	0.636	3,180
			56		(156)

$$IRR = 11\% + \frac{56}{56+156}(12\% - 11\%) = 11.264\%$$

ii) Project B

		NPV at 1st guess rate 10%		NPV at 2nd guess rate 11%	
year	**CFS (Rs.)**	**PVF@10%**	**P. values (Rs.)**	**PVF @ 11%**	**P. values (Rs.)**
0	(10,000)	1	(10,000)	1	(10,000)
1	1,000	0.909	909	0.901	901
2	1,000	0.826	826	0.812	812
3	2,000	0.751	1,502	0.731	1,462
4	10,000	0.683	6,830	0.659	6,590
			67		(235)

$$IRR = 10\% + \frac{67}{67+235}(11\% - 10\%) = 10.22\%$$

PROBLEM NO: 19

Asset 1: Rate of Return = (Operating Profit + Capital Gain) / Investment

= (16000 + 30000) / 400000 = 11.5%

Asset 2: Rate of Return = (Operating Profit - Capital Loss) / Investment

= (34000 – 4000) / 240000 = 12.5%

PROBLEM NO: 20

Discounted Payback Period (Cash flows discounted at 10%):

A -10,000 + 5,454.6 + 1,652.8 + 1,502.6 + 8,196

$$3\,Years + \frac{12}{8{,}196} x\,1{,}390 = 3\,years\,and\,2\,months$$

B -10,000 + 2,272.75 + 2,066 + 3,756.5 + 5,122.50

$$3\,Years + \frac{12}{5{,}122.55} x\,1{,}904.75 = 3\,years\,and\,4.6\,months$$

C -3,500 + 1,363.65 + 2,066 + 375.65 + 5,122.50

$$2\,Years + \frac{12}{375.65} x\,70.35 = 2\,years\,and\,2.25\,months$$

D -3,000 + 0 + 0 + 2,253.9 + 4,098

$$3\,Years + \frac{12}{4{,}098} x\,746.10 = 3\,years\,and\,2.18\,months$$

If standard discounted payback period is 2 years, no project is acceptable on discounted payback period criterion.

If standard discounted payback period is 3 years, Project 'C' is acceptable on discounted payback period criterion.

PROBLEM NO: 21

Step 1: Calculation of P.V of Cash Inflows & NPV

Project	Amount (cash outflows) (Rs.)	P.V of CIFS (Rs.)	NPV (Rs.)	P.I
1	3,00,000	3,66,000	66,000	1.22
2	1,50,000	1,42,500	(7,500)	0.95

3	3,50,000	4,20,000	70,000	1.20
4	4,50,000	5,31,000	81,000	1.18
5	2,00,000	2,40,000	40,000	1.20
6	4,00,000	4,20,000	20,000	1.05

From the above Information it is observed all projects are having +ve NPV except Project B. It is advisable to not to select Project B.

For Selection of all the projects total requirement is Rs.17,00,000, but the availability is Rs.10,00,000. There is budget constraint of Rs.7,00,000.

For Solving these types of problems we have to apply Capital rationing Concept

Capital rationing Concept if given Projects are indivisible Projects.

Combination	Projects	NPV (Rs.)
1	3, 4 & 5	1,91,000 (70,000 + 81,000 + 40,000)
2	3, 5 & 6	1,30,000 (70,000 + 40,000 + 20,000)
3	1, 5 & 6	1,26,000 (66,000 + 40,000 + 20 000)
4	1, 3 & 5	1,76,000 (66,000 + 70,000 + 40,000)

Since combination 1 gives you highest NPV choose combination 1 i.e. Projects 3, 4 and 5.

PROBLEM NO: 22

Evaluation of given Options based on NPV

Option	Cash Outflow (Rs.)	NPV (Rs.)
A Only	1,00,000	1,25,000
B Only	1,50,000	45,000
C Only	1,50,000	90,000
A & B	2,50,000	2,00,000

Based on above information it is advisable to select option A & Option B both at a time and 'C' independently.

The total requirement under this select = Rs. 4,00,000

The Total NPV under this select = Rs. 2,90,000

If there is a budget Constraint of Rs.250000 Then it is advisable to select Option A and Option C independently

Then requirement is Rs.1,00,000 + 1,50,000 = Rs. 2,50,000

NPV is (1,25,000 + 90,000) = Rs. 215000

PROBLEM NO: 23

i) Cost of Project

At 15% IRR the Sum of total cash inflows	= Cost of Project
Annual Cost Saving	= Rs. 96000
Useful Life	= 5yrs
PVAF @ 15%	= 3.533
PV of Cash inflows @ 15%	= Rs. 96,000 x 3.533
	= Rs. 3,21,888
Hence, Cost of Project	= 3,21,888

ii) Payback Period

$$\text{Payback period} = \frac{\text{Cost of Project}}{\text{Annual Cost Savings}} = \frac{3,21,888}{96,000} = 3.353 \text{ years.}$$

iii) Net Present Value:

NPV = PV of CI – Cost of Project = *3,37,982.40 – 3,21,888 = 16,094.4

iv) Cost of Capital

$$P.I = \frac{Sum\ of\ Disc\ CFS}{Sum\ of\ Dis\ Cofs}$$

1.05 = X/3,21,888

$\therefore$ X = 3,21,888 x 1.05 = 3,37,982. 40*

Since, Annual Cost Saving = 96,000

Hence, Cumulative Discount factor for 5 yrs. = $\frac{3,37,982.40}{96,000}$

From Discounted factor table, at discount rate of 13%, the Cumulative discount factor for 5 yrs. is 3.52. Hence, Cost of Capital is 13%.

PROBLEM NO. 24

Working Notes:

1. **Annual Depreciation of Machines:**

Depreciation = $\frac{Cost - Scrap}{life}$

Depreciation of Machine "MX" = $\frac{8,00,000-20,000}{6}$ = Rs.1,30,000.

Depreciation of Machine "MY" = $\frac{10,20,000-30,000}{6}$ = Rs.1,65,000.

2. **Calculation of Cash Inflows**

Machine "MX":

Particulars	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6
Profit Before Depreciation & Tax	2,50,000	2,30,000	1,80,000	2,00,000	1,80,000	1,60,000
Less: Dep.(WN-1)	1,30,000	1,30,000	1,30,000	1,30,000	1,30,000	1,30,000
Profit before tax	1,20,000	1,00,000	50,000	70,000	50,000	30,000
Less: Tax @ 30%	36,000	30,000	15,000	21,000	15,000	9,000
Profit after tax	84,000	70,000	35,000	49,000	35,000	21,000
Add: depreciation	1,30,000	1,30,000	1,30,000	1,30,000	1,30,000	1,30,000
Cash Inflows	2,14,000	2,00,000	1,65,000	1,79,000	1,65,000	1,51,000

Machine "MY":

Particulars	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6
Profit before Depreciation & Tax	2,70,000	3,60,000	3,80,000	2,80,000	2,60,000	1,85,000
Less: Dep.(WN-1)	1,65,000	1,65,000	1,65,000	1,65,000	1,65,000	1,65,000
Profit before tax	1,05,000	1,95,000	2,15,000	1,15,000	95,000	20,000
Less: Tax @ 30%	31,500	58,500	64,500	34,500	28,500	6,000
Profit after tax	73,500	1,36,500	1,50,500	80,500	66,500	14,000
Add: depreciation	1,65,000	1,65,000	1,65,000	1,65,000	1,65,000	1,65,000
Cash Inflows	2,38,500	3,01,500	3,15,500	2,45,500	2,31,500	1,79,000

a) Calculation of Payback Period of each Machine

Cumulative Cash Inflows

Year	Machine "MX"	Machine "MY"
1	2,14,000	2,38,500
2	4,14,000	5,40,000
3	5,79,000	8,55,500
4	7,58,000	11,01,000
5	9,23,000	13,32,500
6	10,74,000	15,11,500

Payback Period for 'MX' = 4 Yrs. + $\frac{8,00,000 - 7,58,000}{1,65,000}$ = 4 Years. + 0.25

= 4.25 Years or 4 Years and 3 months (approx.)

Payback Period for 'MY' = 3 Yrs. + $\frac{10,20,000 - 8,55,500}{2,45,500}$ = 3 Years. + 0.67

= 3.67 Years or 3 Years and 8 months (approx.)

Assumption: It is assumed that cash inflows accrue evenly throughout the year.

b) Calculation of Net Present Value (NPV) of each Machine

Years	PVF@10%	Machine "MX"		Machine "MY"	
		CFAT	PV	CFAT	PV
0	1	(8,00,000)	(8,00,000)	(10,20,000)	(10,20,000)
1	0.909	2,14,000	1,94,526	2,38,500	2,16,797
2	0.826	2,00,000	1,65,200	3,01,500	2,49,039
3	0.751	1,65,000	1,23,915	3,15,500	2,36,941
4	0.683	1,79,000	1,22,257	2,45,500	1,67,677
5	0.621	1,65,000	1,02,465	2,31,500	1,43,762
6	0.564	1,51,000	85,164	1,79,000	1,00,956
7	0.564	20,000	11,280	30,000	16,920
Net Present Value			**4,807**		**1,12,092**

Assumptions:

- Cash flows are assumed to accrue at the end of each year.
- Interim cash inflows at the end of each year are assumed to be reinvested at the rate of cost of capital.
- Cash flows given in the problem are assumed to be certain.

c) Recommendation:

Particulars	Machine 'MX'	Machine 'MY'
Ranking according to Payback Period	II	I
Ranking according to Net Present Value	II	I

Advise: Since Machine 'MY' has higher ranking than Machine 'MX' according to both parameters, i.e. Payback Period as well as Net Present Value, therefore, Machine 'MY' is recommended

PROBLEM NO: 25

i) (i) Calculation of Net Cash Flow (Rs. in lakhs)

Year	Profit before dep. and tax	Depreciation (20% on WDV)	PBT	PAT	Net cash flow
(1)	(2)	(3)	(4)	(5)	(3) + (5)
1	160	400 x 20% = 80	80	40	120
2	160	(400 - 80) x 20% = 64	96	48	112
3	180	(320 - 64) x 20% = 51.2	128.8	64.4	115.6
4	180	(256 - 51.2) x 20% = 40.96	139.04	69.52	110.48
5	150	(204.8 - 40.96) = 163.84*	-13.84	-6.92	156.92

*this is treated as a short term capital loss.

ii) Calculation of Net Present Value (NPV) (Rs. in lakhs)

Year	Net Cash Flow	12%		14%		16%	
		D.F	P.V	D.F	P.V	D.F	P.V
1	120	.89	106.8	.88	105.60	.86	103.2
2	112	.80	89.6	.77	86.24	.74	82.88

3	115.6	.71	82.08	.67	77.45	.64	73.98
4	110.48	.64	70.70	.59	65.18	.55	60.76
5	156.92	.57	89.44	.52	81.60	.48	75.32
			438.62		416.07		396.14
	Less: Initial Investment		400.00		400.00		400.00
	NPV		38.62		16.07		-3.86

iii) Advise: Since Net Present Value of the project at 12% = 38.62 lakhs, therefore the project should be implemented.

iv) Calculation of Internal Rate of Return (IRR)

$$\text{IRR} = 14\% + \frac{16.07 \times 2\%}{16.07 - (-3.86)} = 14\% + \frac{32.14}{19.93} = 14\% + 1.61\% = 15.61\%$$

PROBLEM NO: 26

i) Calculation of Pay-back Period:

Cash Outlay of the Project	80,00,000
Total Cash Inflow for the first five years	70,00,000
Balance of cash outlay left to be paid back in the 6th year	10,00,000
Cash inflow for 6th year	16,00,000

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

$$5\,\text{Years} + \frac{\text{Rs.}10,00,000}{\text{Rs.}16,00,000} = 5.625\,\text{Years or 5 years 7.5 months}$$

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

Year	Net Cash Inflow (Rs.)	Present Value at Discount Rate of 10%	Present Value (Rs.)
	(a)	(b)	(c) = (a)× (b)
1	14,00,000	0.909	12,72,600
2	14,00,000	0.826	11,56,400
3	14,00,000	0.751	10,51,400
4	14,00,000	0.683	9,56,200
5	14,00,000	0.621	8,69,400
6	16,00,000	0.564	9,02,400
7	20,00,000	0.513	10,26,000
8	30,00,000	0.467	14,01,000
9	20,00,000	0.424	8,48,000
10	8,00,000	0.386	3,08,800
			97,92,200

Net Present Value (NPV) = Cash Outflow - Present Value of Cash Inflows

= Rs.80,00,000 - Rs. 97,92,200 = 17,92,200

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

$$\text{Profitability Index} = \frac{\text{Present value of Cash Inflow}}{\text{Cost of the Investment}} = \frac{\text{Rs.}97,92,200}{\text{Rs.}80,00,000} = 1.224$$

iv) Calculation of Internal Rate of Return: Net present value @ 10% interest rate factor has already been calculated in (ii) above, we will calculate Net present value @15% rate factor.

Year	Net Cash Inflow (Rs.)	Present Value at Discount Rate of 15%	Present Value (Rs.)
	(a)	(b)	(c) = (a)× (b)
1	14,00,000	0.870	12,18,000
2	14,00,000	0.756	10,58,400
3	14,00,000	0.658	9,21,200
4	14,00,000	0.572	8,00,800

5	14,00,000	0.497	6,95,800
6	16,00,000	0.432	6,91,200
7	20,00,000	0.376	7,52,000
8	30,00,000	0.327	9,81,000
9	20,00,000	0.284	5,68,000
10	8,00,000	0.247	1,97,600
			78,84,000

Net Present Value at 15% = Rs.78,84,000 – Rs.80,00,000 = Rs. -1,16,000

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:

$$IRR = L + \frac{NPV_L}{NPV_L - NPV_H}(H - L)$$

$$= 10\% + \frac{Rs.17,92,200}{Rs.19,08,200}(10\% - 15\%)$$

$$= 10\% + \frac{Rs.17,92,200}{Rs.19,08,200} x 5\% = 14.7\%$$

PROBLEM NO.27

i) Computation of Discounted Payback Period, Net Present Value (NPV) and Internal Rate of Return (IRR) for Two Machines:

Calculation of Cash Inflows

	Machine – I (Rs.)	Machine – II (Rs.)
Annual Income before Tax and Depreciation	3,45,000	4,55,000
Less: Depreciation		
Machine – I: 10,00,000 /5	2,00,000	-
Machine – II: 15,00,000 / 6	-	2,50,000
Income before Tax	1,45,000	2,05,000
Less: Tax @ 30 %	43,500	61,500
Income after Tax	1,01,500	1,43,500
Add: Depreciation	2,00,000	2,50,000
Annual Cash Inflows	3,01,500	3,93,500

Year	P.V. of Re.1 @ 12%	Machine - I			Machine - II		
		Cash flow	P.V.	Cumulative P.V.	Cash flow	P.V.	Cumulative P.V.
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	3,13,620	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	-	-	-	3,93,500	1,99,505	16,18,074

Discounted Payback Period for:

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

$$= 4 + \frac{84,042}{1,70,951} = 4 + 0.4916$$

= 4.49 years or 4 years and 5.9 months

Machine – II: Discounted Payback Period $= 5 + \frac{(15,00,000 - 14,18,569)}{1,99,505} = 5 + \frac{81,431}{1,99,505} = 5 + 0.4082$

= 5.41 years or 5 years and 4.9 months

Net Present Value for:

Machine – I: NPV = Rs. 10,86,909 – Rs.10,00,000 = Rs. 86,909

Machine – II: NPV = Rs. 16,18,074 – Rs.15,00,000 = Rs. 1,18,074

Internal Rate of Return (IRR) for:

Machine – I: P.V. Factor = $\frac{\text{Initial Investment}}{\text{Annual Cash Inflow}} = \frac{3,01,500}{10,00,000} = 3.3167$

PV factor falls between 15% and 16%

Present Value of Cash inflow at 15% and 16% will be:

Present Value at 15% = 3.353 x 3,01,500 = 10,10,930

Present Value at 16% = 3.274 x 3,01,500 = 9,87,111

$$IRR = 15 + \frac{10,10,930 - 10,00,0000}{10,10,930 - 9,87,111} \times (16 - 15) = 15 + \frac{10,930}{23,819} \times 1 = 15.4588\% = 15.46\%$$

Machine - II

P.V. Factor = $\frac{15,00,000}{3,93,500} = 3.8119$

Present Value of Cash inflow at 14% and 15% will be:

Present Value at 14% = 3.888 x 3,93,500 = 15,29,928

Present Value at 15% = 3.785 x 3,93,500 = 14,89,398

$$IRR = 14 + \frac{15,29,928 - 15,00,000}{15,29,928 - 14,89,398} \times (15 - 14) = 14 + \frac{29,928}{40,530} \times 1 = 14.7384\% = 14.74\%$$

ii) Advise to the Management

Ranking of Machines in terms of the Three Methods

	Machine - I	Machine - II
Discounted Payback Period	I	II
Net Present Value	II	I
Internal Rate of Return	I	II

Advise: Since Machine - I has better ranking than Machine – II, therefore, Machine – I should be selected.

PROBLEM NO. 28

Step 1: Calculation of PV of cash outflows:

Particulars	NM-A1	NM-A2
Cost of the machine	20,00,000	25,00,000

Step 2: Calculation of Depreciation:

Particulars	NM-A1	NM-A2
Depreciation	20,00,000/5	25,00,000/5
	4,00,000	5,00,000

Step 3: Calculation of Present value of CFAT p.a. **(Rs. in Lakhs)**

Particulars	NM - A1	NM - A2
A. Benefits:		
1. Savings in Direct Wages	7,00,000	9,00,000
2. Savings in Scrap	60,000	1,00,000
B. Less: cost		
1. Additional cost of Indirect material	30,000	90,000
2. Additional cost of Indirect material	40,000	50,000
3. Additional cost of Repairs and Maintenance	45,000	85,000

	1,15,000	2,25,000
PBDT [A-B]	6,45,000	7,75,000
Less: Depreciation	4,00,000	5,00,000
Less: Tax @ 30%	73,500	82,500
PAT	1,71,500	1,92,500
Add: Depreciation	4,00,000	5,00,000
CFAT	5,71,500	6,92,500

a) Calculation of Pay Back Period:

i) NM-A1: $PBP = \frac{\text{Initial Investment}}{\text{Annual Cash Inflows}} = \frac{20,00,000}{5,71,500} = 3.499 \sim 3.50 \text{ yrs.}$

ii) NM-A2: $PBP = \frac{\text{Initial Investment}}{\text{Annual Cash Inflows}} = \frac{25,00,000}{6,92,500} = 3.61 \text{ yrs.}$

b) Calculation of ARR:

i) NM - A1: $ARR = \frac{\text{Avg PAT}}{\text{Avg Investment}} x100 = \frac{\left[\frac{1,71,500x5}{5}\right]}{\left[\frac{20,00,000}{2}\right]} x100 = 17.15\%$

ii) NM-A2: $ARR = \frac{\left[\frac{1,92,500x5}{5}\right]}{\left[\frac{25,00,000}{2}\right]} x100 = 15.4\%$

c) Profitability Index of P.V Index:

$\text{Profitability Index} = \frac{\text{Pv of cash Inflows}}{\text{Pv of cash outflows}}$

i) NM-A1: $PI = \frac{[3.605x5,71,500]}{20,00,000} = 1.03$

ii) NM-A2: $PI = \frac{[3.605x6,92,500]}{25,00,000} = 0.998$

Conclusion: It is advisable to select machine NM-A1. Since all the techniques i.e; PBP, ARR and PI are preferring machine NM-A1.

PROBLEM NO: 29

i) Payback Period Method: The cumulative cash flows for each project are as follows:

Year	Cumulative Cash Flows	
	Project X (Rs.)	Project Y (Rs.)
0	(10,000)	(10,000)
1	(3,500)	(6,500)
2	(500)	(3,000)
3	2,500	500
4	3,500	4,000

$\text{Payback X} = 2 + \frac{\text{Rs.500}}{\text{Rs.3,000}} = 2.17 \text{ years}$

$\text{Payback Y} = 2 + \frac{\text{Rs.3,000}}{\text{Rs.3,500}} = 2.86 \text{ years}$

Net Present Value (NPV)

$$NPV_X = -\text{Rs.}10{,}000 + \frac{\text{Rs.}6{,}500}{(1.12)^1} + \frac{\text{Rs.}3{,}000}{(1.12)^2} + \frac{\text{Rs.}3{,}000}{(1.12)^3} + \frac{\text{Rs.}1{,}000}{(1.12)^4}$$

= Rs.966.01

$$NPV_Y = -\text{Rs.}10{,}000 + \frac{\text{Rs.}3{,}500}{(1.12)^1} + \frac{\text{Rs.}3{,}500}{(1.12)^2} + \frac{\text{Rs.}3{,}500}{(1.12)^3} + \frac{\text{Rs.}3{,}500}{(1.12)^4}$$

= Rs.630.72

Internal Rate of Return (IRR)

To solve for each project's IRR, find the discount rates that equate each NPV to zero:

IRR_X = 18.0%.

IRR_Y = 15.0%.

ii) The following table summarizes the project rankings by each method:

	Project that ranks higher
Payback	X
NPV	X
IRR	X

Analysis: All methods rank Project X over Project Y. In addition, both projects are acceptable under the NPV and IRR criteria. Thus, both projects should be accepted if they are independent.

PROBLEM NO.30

Calculation of Net Present Value of each Project: **(Rs. in. thousands)**

Year	PVF @ 12%	Project A		Project B		Project C		Project D	
		Cash flows	PV	Cash flows	PV	Cash flows	PV	Cash flows	PV
0	1	(200)	(200)	(190)	(190)	(250)	(250)	(210)	(210)
1	0.893	50	44.65	40	35.720	75	66.975	75	66.975
2	0.797	50	39.85	50	39.850	75	59.775	75	59.775
3	0.712	50	35.6	70	49.840	60	42.720	60	42.720
4	0.636	50	31.8	75	47.700	80	50.880	40	25.440
5	0.567	50	28.35	75	42.525	100	56.700	20	11.340
NPV			(19.75)		25.635		27.050		(3.750)

Conclusion:

Project	A	B	C	D
NPV	(Rs.19,750)	Rs.25,635	Rs.27,050	(Rs.3,750)

Assumptions:

- Cash flows are assumed to accrue at the end of each year.
- Interim cash inflows at the end of each year are assumed to be reinvested at the rate of cost of capital.
- Cash flows given in the problem are assumed to be certain.

THE END