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

Step 1: Estimation of Cash Outflow

a) Cost of Asset = Rs. 5,00,000

Step 2: Calculation of CFAT

Particulars	Y_1	Y_2	Y_3	Y_4
a) PBDT	2,00,000	2,00,000	2,00,000	2,00,000
b) Depreciation (in WDV Method)	1,25,000	93,750	70,313	52,734
c) PBT (a - b)	75,000	1,06,250	1,29,687	1,47,266
d) Tax @ 40%	30,000	42,500	51,875	58,906
e) PAT (c - d)	40,000	63,750	77,812	88,360
f) CFAT (e + b)	1,65,000	1,57,500	1,48,125	1,41,094

Total Operating Cash Inflows: Rs. 6,11,719

Step 3: Calculation of Terminal Cash Flow (TCI)

Particulars	Amount (Rs.)
a) Gross Sale Proceeds	1,50,000
b) WDV (5,00,000 - 3,41,797)	1,58,203
c) Capital Loss	8,203
d) Tax Shield @ 40%	3,281
e) Net Sale Proceeds (a + d)	1,53,281

Step 4: Estimation of Total Cash Inflow

Total Cash Inflow = Operating Cash Inflows + Terminal Cash Inflows

= Rs.6,11,719 + 1,53,281 = Rs. 7,65,000

PROBLEM NO: 3

Calculation of cash flows i.e. CFAT

Particulars	Y_1
a) PBT	3,00,000
b) Tax @ 40%	1,20,000
c) PAT (a - b)	1,80,000
d) Depreciation	1,00,000
e) CFAT(c + d)	2,80,000

PROBLEM NO: 4

Calculation of ARR

Particulars	Machine A (Rs.)	Machine B (Rs.)
i) Depreciation	$9,600 \left[\frac{50,000-2,000}{5\text{yrs}}\right.$	$9,600 \left[\frac{50,000-2,000}{5\text{yrs}}\right.$
ii) Avg. Investment $\left[\frac{1}{2}(\text{cost}-\text{sv})+\text{sv}+\text{w.cap}\right]$	30,000 $\left[\frac{1}{2}(50,000-2,000)+2,000+4,000\right]$	40,000 $\left[\frac{1}{2}(50,000-2,000)+2,000+14,000\right]$
iii) Avg. PAT	$15,000 \left[\frac{5k+10k+15k+20k+25k}{5}\right.$	$15,000 \frac{\text{PVCOF}}{\text{PVAF (2,9\%)}}$
iv) ARR (iii ÷ ii)	50% $\left[\frac{15,000}{30,000}\times 100\right.$	37.5% $\left[\frac{15,000}{40,000}\times 100\right.$

PROBLEM NO: 5

The Profit after Tax and value of Investment in the Beginning and at the End of the each year shall be as follows:

Year	PBT (Rs.)	Depreciation (Rs.)	Profit after depreciation (Rs.)	Value of Investment in(Rs.)	
				Beginning	End
1	4,00,000	2,00,000	2,00,000	10,00,000	8,00,000
2	4,00,000	2,00,000	2,00,000	8,00,000	6,00,000
3	4,00,000	2,00,000	2,00,000	6,00,000	4,00,000

The ARR can be computed by following methods as follows:

a) Version 1: Annual Basis

$$\text{ARR} = \frac{\text{Profit after depreciation}}{\text{Investment in the beginning of the year}}$$

Year	
1	$= \frac{2,00,000}{10,00,000} \times 100 = 20\%$
2	$= \frac{2,00,000}{8,00,000} \times 100 = 25\%$
3	$= \frac{2,00,000}{6,00,000} \times 100 = 33.33\%$

$$\text{Average ARR} = \frac{20\% + 25\% + 33.33\%}{3} = 26.11\%$$

b) Version 2: Total Investment Basis

$$ARR = \frac{\text{Average Annual Profit}}{\text{Investment in the beginning}} \times 100$$

$$= \frac{(2,00,000 + 2,00,000 + 2,00,000)/3}{10,00,000} \times 100 = 20\%$$

c) Version 3: Average Investment Basis

$$\frac{\text{Average Annual Profit}}{\text{Average Investment}} \times 100$$

Average Investment = ½ (Initial Investment - Salvage Value) + Salvage Value

= ½ (Rs.10,00,000 - Rs. 4,00,000) + Rs. 4,00,000 =Rs.7,00,000

$$= \frac{2,00,000}{7,00,000} \times 100 = 28.57\%$$

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 Rs. 2,00,000 is required as additional working capital during the project life then average investment shall be:

= ½ (Rs.10,00,000 - Rs. 4,00,000) + Rs. 4,00,000 + Rs. 2,00,000 = Rs.9,00,000 and

$$ARR = \frac{2,00,000}{9,00,000} \times 100 = 22.22\%$$

PROBLEM NO: 6

a) Calculation of payback period:

	Cash Flows (Rs. 000)					
Project	**C_0**	**C_1**	**C_2**	**C_3**	**C_4**	**Payback period**
A	-1,000	+600	+200	+200	+1,000	3 years
B	-1,000	+200	+200	+600	+1,000	3 years
C	-300	+100	+100	+100	+600	3 years
D	-300	0	0	+300	+600	3 years

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 four 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: 7

Calculation of payback period:

Situation1:-

When the net cash flows are uniform over the useful life of the project:

$$PBP = \frac{\text{Initial Investment}}{\text{Annual cashinflow}}$$

$$PBP = \frac{6,00,000}{1,50,000} = 4$$

Situation 2:-

When the annual cash flows are not uniform, the cumulative cash flows from operations must be calculated for each year. The PBP shall be corresponding period when total of cumulative cash inflows is equal to the initial capital investment. However, if exact sum does not match then the period in which it lies should be identified. After that we need to compute the fraction of the year that is needed to complete the total payback.

Initial Investment = 37,000

Year	Cash flows	Cumulative cash flows	PBP
1	10,000	10,000	
2	12,000	22,000	
3	15,000	37,000	3rd year
4	5,000	42,000	
5	5,000	47,000	

PROBLEM NO: 8

CALCULATION OF PAY BACK PERIOD OF EACH PROJECT

Particulars	M - I	M - 2	M - 3
Step - 1: Calculation of Dep. P.a. $\left(\frac{\text{Cost} - \text{Scrap Value}}{\text{Life}}\right)$	1,06,250 $\left(\frac{5,00,000-75,000}{4}\right)$	89,000 $\left(\frac{5,00,000-45,000}{5}\right)$	90,000 $\left(\frac{5,00,000-50,000}{5}\right)$
Step-2: Calculation of CFAT p.a.			
Sales	10,00,000	7,50,000	12,50,000
Less:			
Direct Materials	1,00,000	75,000	1,25,000
Direct Labour	1,25,000	1,00,000	1,50,000
Factory Overheads	1,50,000	1,25,000	1,75,000
Administrative Overheads	40,000	30,000	50,000
Selling and Distributive Overheads	20,000	10,000	30,000
Interest on Capital (5,00,000 x 12%)	60,000	60,000	60,000
PBDT	5,05,000	3,50,000	6,60,000
Less: Depreciation (Step - 1)	1,06,250	89,000	90,000
PBT	3,98,750	2,61,000	5,70,000
Less: Tax @ 20%	(79,750)	(52,200)	(1,14,000)
PAT	3,19,000	2,08,800	4,56,000
Add: Depreciation	1,06,250	89,000	90,000
CFAT	4,25,250	2,97,800	5,46,000
Step -3: Calculation of Payback period $\left(\frac{\text{Initial Investment}}{\text{CFAT p.a.}}\right)$	1.176 yrs. $\left(\frac{5,00,000}{4,25,250}\right)$	1.68 yrs. $\left(\frac{5,00,000}{2,97,800}\right)$	1.597 yrs. $\left(\frac{5,00,000}{5,46,000}\right)$

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

Decision Making:

- If the given 3 machines are assumed to be mutually exclusive then accept the machine with least payback period i.e. Machine 1.
- If the given 3 machines are assumed to be mutually independent then purchase all the machines whose payback period is less than the standard payback period, subject to availability of funds.

PROBLEM NO: 9

a) Computation of NPV:

Particulars	Machine is repaired			Machine is replaced		
	Cash Flow	PVAF @ 12%	PV of CF	Cash Flow	PVAF @ 12%	PV of CF
$Y_1 - Y_3 / Y_4$	80,000	2.402	1,92,160	80,000	3.038	2,43,040
Y_3 / Y_4	60,000	0.712	42,720	30,000	0.636	19,080

			2,34,880			2,62,120
Y_0	2,00,000	1.000	(2,00,000)	2,00,000	1.000	(2,00,000)
Y_1 / Y_2	50,000	0.893	(44,650)	70,000	0.797	(55,790)
			(9,770)			6,330

Since the replacement option gives higher NPV, The machine should be replaced.

b) Discount offered by the supplier:

The discount Rs. 70,000 being the common benefit for both the options. Common benefits were not relevant for decision making. Hence, it would have no impact on current decision. i.e. No change in decision.

PROBLEM NO: 10

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: 11

(i) Calculation of net cash flows

Year	Profit before Dep. and tax	Depreciation (20% on WDV)	PBT	PAT	Net cash flow
1	160	400x20% = 80	80	40	103.2
2	160	(400-80)x20% = 64	96	48	82.88
3	180	(320-64)x20% = 51.2	128.8	64.4	73.98
4	180	(256-51.2)x20% = 40.96	139.04	69.52	60.76
5	150	(204.8-40.96) x20% = 163.84*	-13.84	-6.92	75.32

*this is treated as a short term capital loss

(ii)Calculation of Net Present value(

Year	Net cash flow	12%		14%		16%	
		D.F	P.F	D.F	P.F	D.F	P.F
1	120	0.89	106.8	0.88	105.60	0.86	103.2
2	112	0.80	89.6	0.77	86.24	0.74	82.88
3	115.6	0.71	82.08	0.67	77.45	0.64	73.98
4	110.48	0.64	70.70	0.59	65.18	0.55	60.76
5	156.92	0.57	89.44	0.52	81.60	0.48	75.32
			436.62		416.07		396.14
Less : Initial Investment			400.00		400.00		400.00
NPV			38.62		16.07		-3.86

Advise: Since Net Present Value of the project at 12% = 38.62 lakhs, therefore the

project should be implemented.

(iii) **Calculation of Internal Rate of Return (IRR)**

$$IRR = 14\% + \frac{16.07 \times 2\%}{16.07 - (-3.86)}$$

= 14%+32.14/19.93 = 14% + 1.61% = 15.61%

PROBLEM NO: 12

Computation of NPV:

Step 1: Investment

Year	Investment	PVF @ 15%	PV of CF
0	3,15,000	1.000	3,15,000
1	1,35,000	0.870	1,17,450
			4,32,450

Step 2: CFAT

Particulars	Y_1	Y_2	Y_3 to Y_5
Sales Volume	60,000	60,000	60,000
Contribution (10 - 4)	6	6	6
Total Contribution	3,60,000	3,60,000	3,60,000
Less: Fixed Cost (Exc. Depreciation)	(25,000)	(25,000)	(25,000)
	3,35,000	3,35,000	3,35,000
Less: Sales Promotion Expenses	(60,000)	(75,000)	-
PBDT/ PBT/ CFAT (Since, No Taxes)	2,75,000	2,60,000	3,35,000

Step 3: Present Value of Cash Flows

Particulars	CFAT	PVF @ 15%	Present Value of Cash Flow
Y_1	2,75,000	0.870	2,39,250
Y_2	2,60,000	0.756	1,96,560
Y_3 - Y_5	3,35,000	1.727	5,78,545
Y_5	75,000	0.497	37,275
Sum of Present Value of Cash Inflows			10,51,630

Step 4: Computation of NPV

Sum of Present Value of Cash Inflows	10,51,630
Less: Sum of Present Value of Cash Outflows	(4,32,450)
NPV	6,19,180

Since, NPV is positive Machine can be purchased

Note: Fixed Cost Excluding Depreciation

Fixed Cost Including Depreciation	1,00,000
Less: Depreciation $\left(\frac{4,50,000 - 75,000}{5}\right)$	(75,000)
	25,000

PROBLEM NO: 13

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: 14

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

3^{rd} year = $\frac{2,20,000}{55} \times 8$ = Rs. 32,000 4^{th} year = $\frac{2,20,000}{55} \times 7$ = Rs. 28,000

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

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

10^{th} 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 (Rs.)
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. (6,662)

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: 15

Step 1: Calculation of Depreciation

Particulars	Y_1 to Y_2	Y_3 To Y_8
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 lakhs

Step 3 P.V of Operating Cash inflows

Particulars	Y_1	Y_2	Y_3 to Y_5	Y_6 to Y_8
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 **(Rs. in lakhs)**

Particulars	Amount (Rs.)
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.

NOTE: Students are advised to rectify the hint answer given in our material as per the computation above.

PROBLEM NO: 16

Step1:

Cash out flows:

Additional pump = 80,00,000

Additional working capital = 20,00,000

Total = 1,00,00,000

Step2:

$$\text{Depreciation} = \frac{\text{cost} - \text{scrap}}{\text{life}}$$

$$= \frac{80,00,000 - 0}{10} = 8,00,000 \text{ p.a}$$

Step3:increamental operating cash inflows:

particulars	Amt Rs.
Commission on sales [(6,00,000*80)+(3,50,000*60)]*6%	41,40,000
Less:	
Salary to pump operator	1,50,000
Insurance (80,00,000*3%)	2,40,000
Maintenance cost	1,00,000
Power cost	1,75,000
Depreciation	8,00,000
Profit before tax	26,75,000
Tax (26,75,000*40%)	10,70,000
Profit after tax	16,05,000
Add: depreciation	8,00,000
CFAT	24,05,000

PV of operating cash inflows=PVF(15%,10Y)x24,05,000

=24,05,000x5.0188

=1,20,70,214

Step4: Terminal cash inflows

particulars	Amt Rs.
Working capital(20,00,000*02472)	4,94,400

Step5:increamental NPV

=PV of cash inflows-PV of cash out flows

=1,20,70,214+4,94,400-1,00,00,000

=25,64,614

PROBLEM NO: 17

Computation of NPV under different alternatives

Project (s)	PV of Cash Flows (A)	Investment (B)	NPV (C = A - B)
1	5,80,000	4,00,000	1,80,000
2	3,70,000	2,30,000	1,40,000
3	8,00,000	5,40,000	2,60,000

1 & 2	9,50,000	6,30,000	3,20,000
1 & 3	13,80,000	9,00,000	4,80,000
2 & 3	12,70,000	7,70,000	**5,00,000**
1, 2 & 3	16,00,000 (12,70,000 + 5,80,000 - 2,50,000)	11,30,000 (9,00,000 + 2,30,000)	4,70,000

The combination of Projects 2 & 3 gives highest NPV, Should be selected

PROBLEM NO: 18

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)

$$\text{Profitability Index} = \frac{\text{Sum of Discounted Cash Inflows}}{\text{Present value of cash outflows}} = \frac{\text{Rs. } 74,944.36}{\text{Rs. } 80,000} = 0.937$$

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: 19

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

1. $\frac{8,55,000}{7,50,000} = 1.14$
2. $\frac{4,25,000}{3,50,000} = 1.21$
3. $\frac{7,25,000}{5,50,000} = 1.32$

It would be seen that in absolute terms project 3 gives the highest cash inflows yet its desirability factor is low. This is because the outflow is also very high. The Desirability/ Profitability Index factor helps us in ranking various projects.

Since PI is an extension of NPV it has same advantages and limitation

PROBLEM NO: 20

$$\text{Pay Back Reciprocal} = \frac{\text{Average Annual Cash Inflows}}{\text{Initial Investment}} \times 100$$

Initial investment = Rs. 1,00,000

Annual cash inflow = Rs. 25,000

Payback reciprocal = 25,000/1,00,000

Pay back reciprocal = 25%

PROBLEM NO: 21

A) at **IRR**

PV of Cash outflow = PV of Cash inflow

36,000 =11,200Xpvaf(r%,5Y)

pvaf(r%,5Y) =3.2143

PVAF at @16% =3.2743

PVAF at @18% =3.1272

For 2% difference=0.1471

PVAF at @16% =3.2743

PVAF at @16%(r%,5y) =3.2143

Difference =0.06

0.1471 → 2%

0.06 → ? (0.06x2/0.1471=0.816)

Therefore r=16+0.816=16.816=17%(approx)

B) Project 1:

at IRR PV of Cash outflow= PV of Cash inflow

PV of Cash outflow = 25,000

PV of Cash inflow =30,000 X pvf(r%,1)

25,000 =30,000 X pvf(r%,1)

pvf(r%,1) =25000/30000

=0.8333

In PVF table,0.8333 against 1 year

Is at 20%

Therefore r=20%,i.e IRR=20%

Project 2:

at IRR PV of Cash outflow = PV of Cash inflow

PV of Cash outflow = 25,000

PV of Cash inflow =43,750 X pvf(r%,4)

25,000 =43,750 X pvf(r%,4)

pvf(r%,4) =25000/43,750

=0.5714

In PVF table,0.5714 against 4 year

Is at 15%(approx)

Therefore r=15%,i.e IRR=15%

C)

computation of IRR for project A:

Years	At 11%			At 12%		
	Pv factor	Cash flow	Pv of Cash flow	Pv factor	Cash flow	Pv of Cash flow
0	1	(11,000)	(11,000)	0	1	(11,000)
1	0.9009	6000	5405	1	0.893	5358
2	0.8116	2000	1623	2	0.7972	1594
3	0.7312	1000	731	3	0.7117	712
4	0.6587	5000	3294	4	0.6355	3178
NPV			53	NPV		(158)

IRR=

$$LR + \frac{\text{NPV at LR}}{\text{NPV at LR} - \text{NPV at HR}} X\,(HR - LR)$$

$$= 11\% + \frac{53}{53 - (158)} X\,(12\% - 11\%)$$

=11%+0.251%

=11.251%

Computation of IRR for project B:

Years	At 10%			At 11%		
	Pv factor	Cash flow	Pv of Cash flow	Pv factor	Cash flow	Pv of Cash flow
0	1	(10,000)	(10,000)	0	(10,000)	(10,000)
1	0.909	1000	909	1	0.893	901
2	0.826	1000	826	2	0.7972	812
3	0.751	2000	1502	3	0.7117	1462
4	0.683	10,000	6830	4	0.6355	6587
NPV			67	NPV		(238)

IRR:

$$= LR + \frac{\text{NPV at LR}}{\text{NPV at LR} - \text{NPV at HR}} X\,(HR - LR)$$

$$= 10\% + \frac{67}{67 - (238)} X\,(11\% - 10\%)$$

=10%+0.2196%

=10.2196%

PROBLEM NO: 22

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

= (16,000 + 30,000) / 4,00,000 = 11.5%

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

= (34,000 - 4,000) / 2,40,000 = 12.5%

PROBLEM NO: 23

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

A: (10,000) + 5,454.6 + 1,652.8 + 1,502.6 + 8,196

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

B: (10,000) + 2,272.75 + 2,066 + 3,756.5 + 5,122.50

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

C: (3,500) + 1,363.65 + 2,066 + 375.65 + 5,122.50

$$2\text{Years}+\frac{12}{375.65}\text{x}70.35=2\text{yearsand}2.25\text{months}$$

D: (3,000) + 0 + 0 + 2,253.9 + 4,098

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

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: 24

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: 25

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: 26

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%	= 3.353
PV of Cash inflows @ 15%	= Rs. 96,000 x 3.353
	= 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

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

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: 27

Working Notes:

1. **Annual Depreciation of Machines:**

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

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.28

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.

The End