2. INVESTMENT DECISIONS

PROBLEM NO: 1

Calculation of ARR

Particulars	Machine A (Rs.)	Machine B (Rs.)
i) Depreciation ∴	9600 $\left[\dfrac{50000-2000}{5\,yrs}\right]$	9600 $\left[\dfrac{50000-2000}{5\,yrs}\right]$
ii) Avg.Investment $\left[\dfrac{1}{2}(cost-sv)+sv+w.cap\right]$	30000 $\left[\dfrac{1}{2}(50000-2000)+2000+4000\right]$	40000 $\left[\dfrac{1}{2}(50000-2000)+2000+14000\right]$
iii) Avg PAT	15000 $\left[\dfrac{5k+10k+15k+20k+25k}{5}\right]$	15000 $\left[\dfrac{25k+20k+10k+15k+5k}{5}\right]$
iv) ARR (iii ÷ ii)	50% $\left[\dfrac{15000}{30000}\times100\right]$	37.5% $\left[\dfrac{15000}{40000}\times100\right]$

PROBLEM NO: 2

Calcuation 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: 3

Calculation of CFAT   **(Amount in Rs.)**

Particulars	y_1	y_2	y_3	y_4
PBDT	45000	30000	25000	35000
Less: Depreciation	(25000)	(25000)	(25000)	(25000)

PBT	20000	5000	0	10000
Less: Tax @ 20%	(4000)	(1000)	0	(2000)
PAT	16000	4000	0	8000
Add: Depreciation	25000	25000	25000	25000
CFAT	41000	29000	25000	33000

WORKING NOTE:

Calculation of Depreciation: $\dfrac{6559}{6559-1231}$

PROBLEM NO: 4

Calculation of PBP

i) If initial cash outflows are Rs.200000

Year	CFS (Rs.)	Cum CFS (Rs.)
1	80000	80000
2	60000	140000
3	60000	200000
4	20000	220000

Pay back Period = 3 yrs.

ii) If Initial Cash Outflows are Rs.2,05,000

Year	CFS (Rs.)	Cum CFS (Rs.)
1	80000	80000
2	60000	140000
3	60000	200000
4	20000	220000

Pay back Period = 3 yrs + 5000/20000

= 3.25 yrs.

Note: It is assumed that CFS accrues evenly throughout the year.

PROBLEM NO: 5

Calculation of NPV

Year	CFS (Rs.)	PVF@10%	P.values (Rs.)
0	(100000)	1	(100000)
1	55000	0.909	49995
2	80000	0.826	66080
3	15000	0.751	11265
NPV			27340

PROBLEM NO: 6

i)   Calculation of pay back period

Project A

Initial Investment = 5000

Year	CFS (Rs.)	Cum CFS (Rs.)
1	1000	1000
2	1000	2000
3	3000	5000
4	0	0

PBP = 3 yrs

Project B

Initial Investment = 1000

Year	CFS (Rs.)
1	0
2	1000
3	2000
4	3000

PBP = 2 yrs

Project C

Initial Investment = 5000

Year	CFS (Rs.)	Cum CFS (Rs.)
1	1000	1000
2	1000	2000
3	3000	5000
4	5000	10000

PBP = 3 yrs

ii) If the Cut-off period is 2 Years it is advisable to accept project B only, because it is having Lowest PBP.

Calculation of NPV:

Project: A

Year	CFS (Rs.)	PVF @ 10%	P.values (Rs.)
0	(5000)	1	(5000)
1	1000	0.909	909
2	1000	0.826	826
3	3000	0.751	2253
4	0	0.683	0
			(1012)

Project B

Year	CFS (Rs.)	PVF @ 10%	P. values (Rs.)
0	(1000)	1	(1000)
1	0	0.909	0
2	1000	0.826	826
3	2000	0.751	1502
4	3000	0.683	2049
NPV			3377

Project C

Year	CFS (Rs.)	PVF@10%	P.values (Rs.)
0	(5000)	1	(5000)
1	1000	0.909	909
2	1000	0.826	826
3	3000	0.751	2253
4	5000	0.683	3415
NPV			2403

Conclusion: Projects B and Project C are having positive NPVs and Project A is having negative NPV.

d) FALSE.

No PBP does not give too much weight to cash flows that occur after the Cut-off date it gives too much weigh to cash flows that occur before the Cut off date.

e) TRUE.

Yes, If a firm used a single Cut-off period for all projects, it is Likely to accept too many short-Live projects.

PROBLEM NO: 7

Calculation of NPV

Project A

Year	CFS	PVF @ 10%	P.values
0	(10000)	1	(10000)
1	6000	0.9091	5455
2	2000	0.8264	1653
3	2000	0.7513	1503
4	12000	0.6830	8196
NPV			6807

Project B

Year	CFS	PVF@10%	P.values
0	(10000)	1	(10000)
1	2500	0.9091	2273
2	2500	0.8264	2066
3	5000	0.7513	3756
4	7500	0.6830	5122
NPV			3217

Project C

Year	CFS	PVF@10%	P.values
0	(3500)	1	(3500)
1	1500	0.9091	1364
2	2500	0.8264	2066
3	500	0.7513	376
4	5000	0.6830	3415
NPV			3720

Project D

Year	CFS	PVF@10%	P.values
0	(3000)	1	(3000)
1	0	0.9091	0
2	0	0.8264	0
3	3000	0.7513	2254
4	6000	0.6830	4098
NPV			3352

Decision

NPV technique is superior to any other technique in Capital Budgeting so, NPV guarantees the choice of best alternative.

Based on NPV it is advisable to select project A, because it is having highest NPV.

PROBLEM NO: 8

Calculation of NPV

Step 1: Calculation of P.V of initial cash outflows

    Initial investment = 200 L

Step 2 : Calculation of P.V of operating Cash Inflows   (Rs in Lakhs)

Particulars	y_1	y_2	y_3	y_4	y_5
PBDT	80	80	90	90	75
Less: Dep @ 20%	(40)	(32)	(25.6)	(20.48)	(16.384)
PBT	40	48	64.4	69.52	58.616
Less: Tax @ 50%	(20)	(24)	(32.2)	(34.76)	(29.30)
PAT	20	24	32.2	34.76	29.30
Add: Dep	40	32	25.6	20.48	16.384
CFAT	60	56	57.8	55.24	45.69
PVF @ 12%	0.893	0.797	0.712	0.636	0.567
Present Value	53.58	44.632	41.154	35.133	25.91

∴ P.V of Operating CIFs   = Rs.200.409 lakhs

Step 3 Calculation of P.V of Terminal CFs

      NSP = GSP + C.Gs Tax Shield

          = 0 + 32.768

          = 32.768L

Particulars	Amount (Rs. in lakhs)
Gsp	0
W.D.V	(65.536)
C.Loss	65.536
C.Gs Tax Shield	32.768

P.V of Terminal CIFS = Rs.32.768 lakhs x 0.567

          = Rs.18.579 lakhs

Step 4

NPV= P.V of (operating CIFS + Terminal CFS) – PV of Initial cash outflows.

NPV = (18.579 + 200.409) – 200

    = Rs. 18.99 L

Decision:- Since NPV is +ve it is advisable to accept the project

PROBLEM NO: 9

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

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	80000	120000	300000	200000
Contribution per unit (100-40)	Rs.60	Rs.60	Rs.60	Rs.60
Total Contribution (Rs.)	4800000	7200000	18000000	12000000
Less: Fixed Cost (Rs.)	(1600000)	(1600000)	(1600000)	(1600000)
Adv .Cost (Rs.)	(3000000)	(1500000)	(1000000)	(400000)
PBDT (Rs.)	200000	4100000	15400000	10000000
Less: Depreciation (Rs.)	(1750000)	(1750000)	(1900000)	(1900000)
Loss/PBT (Rs.)	(1550000)	2350000	13500000	8100000
Less: (Tax @50%) / Tax Shield (Rs.)	775000	1175000	6750000	4050000
(Loss)/PAT (Rs.)	(775000)	1175000	6750000	4050000
Add: Depreciation (Rs.)	1750000	1750000	1900000	1900000
CFAT (Rs.)	975000	2925000	8650000	5950000
PVF@12%	0.893	0.797	1.915	1.363
Present values (Rs.)	870675	2331225	16564750	8109850

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 W.cap	15.00
Total Terminal CIFs	16.00

P.V thereof = Rs.16 lakhs x 0.404

= Rs.646400

Step 5: Calculation of NPV

NPV = PV of CIFs – PV of COFs

= Rs. 27876500 + Rs. 646400 – Rs. 14297000

= Rs.14225900

PROBLEM NO: 10

Step 1 Calculation of P.V of initial Cash Outflows   **Amount (Rs. in lakhs)**

Particulars	Y_0	Y_1	Y_2	Y_3	Y_4	Y_5
Land	2	1	1	1	-	-
Factory Building	2	-	10	8	-	-
P & M	-	-	-	-	15	5
Working Capital	-	-	-	-	-	1
Total	4	1	11	24	5	1
PVF @ 12%	1.000	0.893	0.797	0.712	0.636	0.567
Present Values (Rs.)	400000	89300	876700	1708800	318000	56700

∴ P.V of initial Cash Outflows = Rs.3449400

Step 2: Calculation of P.V of Operating CIFS

Particulars	Amount (in Lakhs)
Sales	30
Less: Variable Cost	12
Contribution	18
Less: Fixed Cost	(8)
PBDT	10
Less: Depreciation	
On Building (20 x 5%) 1L	
On P & M (20 x 10%) 2L	(3)
PBT	7
Less: Tax@50%	(3.5)
PAT	3.5
Add: Depreciation	3.0
CFAT	6.5

P.V thereof = 6.5L x (6.811 – 3.605) = CFAT (PVA f for 15 yrs – PVA f for 5yrs)

        = 6.5 L x (3.206)

        = Rs. 2083900

Step 3: Calculation of P.V of Terminal CIFS   **(Rs. in Lakhs)**

Particulars	Land	Building	P&M	Total
a) GSP	8	6	2	16
b) WDV	(5)	(10)	(0)	(15)
c) C.G	3	(4)	2	1L
d) C. Gain Tax @ 50% / Tax Shield	1.5	(2)	1	0.5L
e) NSP (a – d)	6.5	8	1	15.5L
f) Add: Recovery of W.cap				1.0L
Total Terminal CIFs				16.5L

P.V thereof = Rs.16.5L x 0.183

        = Rs.301950

Step 4: Calculation of NPV

    NPV = Rs.2083900 + Rs.301950 – Rs.3449400

        = Rs.(1063550)

Step 5: Since NPV is – ve, it is not advisable to accept the proposal

PROBLEM NO: 11

i) **Calculation of NPV for Project A & Project B**

Year	PVF@10%	Project A (Rs.)		Project B (Rs.)	
		CFS	P.V of CFS	CFS	P.values
0	1	(100000)	(100000)	(300000)	(300000)
1	0.909	50000	45450	140000	127260
2	0.826	60000	49560	190000	156940
3	0.751	40000	30040	100000	75100
	NPV		25050		59300

ii) **Calculation of IRR for Project A**

Year	CFS (Rs.)	NPV at 1st guess rate 24% (Rs.)		NPV at 2nd guess rate 25% (Rs.)	
		PVF@24%	P. values (Rs.)	PVF@25%	P. values (Rs.)
0	(100000)	1	(100000)	1	(100000)
1	50000	0.806	40300	0.800	40000
2	60000	0.650	39000	0.640	38400
3	40000	0.524	20960	0.512	20,480
			260		(1120)

$$IRR = L_1 + \frac{NPV\,at\,L_1}{NPV\,at\,L_1 - NPV\,at\,L_2}(L_2 - L_1)$$

$$= 24\% + \frac{260}{260 + 1120}(25\% - 24\%)$$

$$= 24.18\%$$

Calculation of IRR for Project B

Year	CFS	NPV at 1st guess rate 21% (Rs.)		NPV at 2nd guess rate 22% (Rs.)	
		PVF @ 21%	P.values	PVF @ 22%	P.values
0	(300000)	1	(300000)	1	(300000)
1	140000	0.826	115640	0.820	114800
2	190000	0.683	129770	0.672	127680
3	100000	0.564	56400	0.551	55100
NPV			1810		(2420)

$$IRR = 21\% + \frac{1810}{1810 + 2420}(22\% - 21\%)$$

$$= 21.42\%$$

PROBLEM NO: 12

Step 1: Calculation of equivalent Annual Cost of Mach A

Calculation of p.v of Cash Outflows   (Rs.)

Year	CFS (Rs.)	PVF @ 10%	P. values (Rs.)
0	150000	1	150000
1 to 3	40000	2.487	99480
P.V of initial COFs			249480

$$\text{Equivalent Annual Cost} = \frac{P.V\,of\,COFs}{PVAF(nyrsr\%)} = \frac{PV\,of\,COFS}{PVAF\,(3,10\%)}$$

$$= Rs.\frac{249480}{2.487}$$

$$= Rs.100314$$

Step 2: Calculation of Equivalent Annual Cost for mach B   (Rs.)

Year	CFS (Rs.)	PVF @ 10%	P. values (Rs.)
0	100000	1	100000
1 to 2	60000	1.736	104160
			204160

$$\text{Equivalent Annual Cost} = \frac{Rs.204160}{1.736}$$

$$= Rs.117604$$

Step 3: Decision: Since Annualised Cost of Mach A is Lower than Annualised Cost of Mach B, it is advisable to accept mach A.

PROBLEM NO: 13

Step 1: Equivalent Annual Cost of Mach A   (Amount Rs.)

Year	CFS (Rs.)	PVF@9%	P.values (Rs.)
0	750000	1	750000
1 to 3	200000	2.531	506200
			1256200

Equivalent Annual Cost $= \dfrac{PVCOF}{PVAF(3,9\%)} = \dfrac{1256200}{2.531}$ (COF - cash out flows)

$$= 496325$$

Step 2: Equivalent Annual Cost of Mach B

Year	CFS (Rs.)	PVF @ 9%	P.values (Rs.)
0	500000	1	500000
1 to 2	300000	1.759	527700
			1027700

Equivalent Annual Cost $= \dfrac{PVCOF}{PVAF(2,9\%)} = \dfrac{Rs.\,1027700}{1.759}$

$$= Rs.\ 584252$$

Step 3 : Decision Since equivalent Annual Cost of mach A is Lower than equivalent Annual Cost of mach B, it is advisable to accept machine A

PROBLEM NO: 14

Step 1: Equivalent Annual Cost of Mach EM

Year	Description	CFS (Rs.)	PVF @ 14%	P. values (Rs.)
0	Purchase	1000000	1	1000000
1 to 12	Repairs	100000	5.660	566000
8th	Overhauling	200000	0.351	70200
12th	Scrap	(150000)	0.208	(31200)
				1605000

Equivalent Annual Cost $= \dfrac{PVCOF}{PVAF(12,14\%)} = \dfrac{Rs.\,1605000}{5.660}$

$$= Rs.\ 283569$$

Step 2: Equivalent Annual Cost of Mach LM

Year	Description	CFS (Rs.)	PVF @ 14%	P.values (Rs.)
0	Purchase	700000	1	700000
1 to 6	Repair	140000	3.889	544460
4th	Overhauling	100000	0.592	59200
6th	Scrap	(150000)	0.456	(68400)
				1235260

Equivalent Annual Cost $= \dfrac{PVCOF}{PVAF(6,14\%)} = \dfrac{Rs.\,1235260}{3.889}$

$$= Rs.\ 317629$$

Step 3: Decision

    Select machine EM

PROBLEM NO: 15

Step 1 : Calculation of modified NPV for Project X

Calculation of Modified Value

Year	CFS (Rs.)	No.of yrs	Re-invest Rate	FVF@15%	F.values (Rs.)
1	40000	6	15%	2.313	92520
2	50000	5	15%	2.011	100550

3	60000	4	15%	1.749	104940
4	70000	3	15%	1.521	106470
5	80000	2	15%	1.322	105760
6	90000	1	15%	1.150	103500
7	100000	0	15%	1.000	100000
					713740

Modified NPV = Rs.(713740 x 0.425) – 300000

= Rs.303339.5 – 300000

= Rs.3339.5

Step 2 : Calculation of modified NPV for project Y

Year	CFS (Rs.)	No.of yrs	Re-invested rate	FVF@15%	F.values (Rs.)
1	80000	6	15%	2.313	185040
2	70000	5	15%	2.011	140770
3	60000	4	15%	1.749	104940
4	60000	3	15%	1.521	91260
5	50000	2	15%	1.322	66100
6	40000	1	15%	1.150	46000
7	30000	0	15%	1.000	30000
					664110

Modified NPV = (664110 x 0.425) – 300000

= Rs.(17753)

PROBLEM NO: 16

From the given information

Annual Cash inflows	= 11200
P.V of Cash flows	= 36000
No.of yrs	= 5yrs
IRR	= ?

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

Rs.36000 = 11200 x PVAF (5yrs r%)

PVAF = 36000/11200

= 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%)
30000	25000 x FVF (1 yr r%)
FVF	30000/25000
	1.2

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

ii) Project II

Particulars	Amount (Rs.)
Present Value	25000
Future Value	43750
No.of yrs	4 yrs
R	?
43750	25000 x FVF(4yr r%)
FVF	43750/25000
	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	(11000)	1	(11000)	1	(11000)
1	6000	0.901	5406	0.893	5358
2	2000	0.812	1624	0.797	1594
3	1000	0.731	731	0.712	712
4	5000	0.659	3295	0.636	3180
			56		(156)

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

$$= 11.264\%$$

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	(10000)	1	(10000)	1	(10000)
1	1000	0.909	909	0.901	901
2	1000	0.826	826	0.812	812
3	2000	0.751	1502	0.731	1462
4	10000	0.683	6830	0.659	6590
			67		(235)

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

$$= 10.22\%$$

PROBLEM NO: 19

From the given information

Initial investment   = Rs.20000

Annual Cash inflows   = Rs.4000

i) Pay back period $= \dfrac{Initial Investment}{Annual CIFS}$

= Rs.20000/4000

= 5 yrs

ii) Pay back reciprocal   = 1/5 x 100

= 20%

PROBLEM NO: 20

Calculation of Modified Value

Year	CFS (Rs.)	No.of yrs	Re-inve Rate	FVF@4%	F values (Rs.)
1	50000	3	4%	1.125	56250
2	40000	2	4%	1.082	43280
3	30000	1	4%	1.040	31200
4	10000	0	4%	1.000	10000
					140730

Calculation of Modified IRR

Particulars	Amount (Rs)
Initial investment (PV)	100000
Terminal Value (FV)	140730
No.of yrs	4 yrs
FV	PV x FVF (n yrs r%)
140730	100000 x FVF(4 yrs r%)
FVF(4 yrs r%) = 1.4073	

Trace this Value against 4 yrs in FVF Table

r = 9%

∴ Modified IRR = 9%

PROBLEM NO: 21

i)   Calculation of P.V of Operating CIFs   **(Rs. in Lakhs)**

Particulars	Y_1	Y_2	Y_3	Y_4	Y_5
PBDT	160	160	180	180	150
Less: Dep@20% WDV	80	64	51.2	40.96	32.768
PBT	80	96	128.8	139.04	117.32
Less: Tax	40	48	64.4	69.52	58.616
PAT	40	48	64.4	69.52	58.616
Add: Dep	80	64	51.2	40.96	32.768
CFAT	120	112	115.6	110.48	91.384
PVF @ 12%	0.89	0.80	0.71	0.64	0.57
P.values	106.8	89.6	82.08	70.70	52.01

P.V of Operating CIFs = Rs.401.19 lakhs

ii) Calculation of P.V of Terminal CIFs

Terminal CIFs

NSP = GSP + C.Gs Tax Shield

= 0 + 65.536

= 65.536 lakhs

P.V = 65.536 x 0.57 = 37.35 lakhs

GSP	0
WDV	(131.072)
Cap Loss	131.072
C.G Tax @ 50%	65.536

iii) Calculation of NPV

NPV = 401.19 + 37.35 − 400

= Rs. 38.54 L

Calculation of IRR (Rs. in lakhs)

		NPV at 1st guess rate14%		NPVat 2nd guess rate16%	
Year	CFS (Rs.)	PVF@14%	P. values (Rs.)	PVF @16%	P.values (Rs.)
0	(400)	1	(400)	1	(400)
1	120	0.88	105.60	0.86	103.2
2	112	0.77	86.24	0.74	82.88
3	115.6	0.67	77.45	0.64	73.98
4	110.48	0.59	65.18	0.55	60.76
5	156.92	0.52	81.60	0.48	75.32
			16.07		(3.86)

$$\text{IRR} = 14\% + \frac{16.07}{16.07 + 3.86}(16\% - 14\%)$$

$$= 15.61\%$$

PROBLEM NO: 22

Calculation of CFAT (Amount in Rs.)

Particulars	Y₁	Y₂	Y₃	Y₄	Y₅
PBDT	90000	130000	170000	116000	19500
Less: Depreciation	(53000)	(53000)	(53000)	(53000)	(53000)
PBT	37000	77000	117000	63000	(33500)
Less: Tax	20000	30000	40000	26000	5000
PAT	17000	47000	77000	37000	(28500)
Add: Depreciation	53000	53000	53000	53000	53000
CFAT	70000	100000	130000	90000	24500

Calculation of P.V of CFS (Amount in Rs.)

		At 11%		At 12%		At 13%		At 14%		At 15%	
Year	CFS	PVF	P values	PVF	P values	PVF	P values	PVF	P values	PVF	P values
1	70000	0.909	63630	0.8929	62503	0.8850	61950	0.8770	61390	0.8696	60830
2	100000	0.8116	81160	0.7972	79720	0.7831	78310	0.7695	76950	0.7561	75610
3	130000	0.7312	95056	0.7118	92534	0.6931	90103	0.6750	87750	0.6575	85475
4	90000	0.6587	59283	0.6355	57195	0.6133	55197	0.592	53280	0.5718	51462
5	14500	0.5953	8632	0.5674	8227	0.5428	7871	0.5194	7531	0.4972	7209
5th	45500	0.5953	27086	0.5674	25817	0.5428	24697	0.5194	23633	0.4972	22622
			334847		325996		318128		310543		303208

IRR means the rate at which,

PV of cash outflow = PV of Cash inflow

Conclusion: As <u>Rs.310500</u> is matched with present value at 14%, return of project = 14%

Therefore, return of project = 14%

PROBLEM NO: 23

Part I: Calculation of NPV

Step 1: Calculation of Depreciation

$$\text{Depreciation (Rs.)} = \frac{\text{Cost} - \text{Sv}}{\text{Life}}$$

$$= \frac{80000 - 6000}{8}$$

$$= 9250$$

Step 2 : Calculation of P.V of initial Cash Outflow

P.V of initial COFs (Rs.)   = 80000

Step 3 : Calculation of P.V of Operating Cash inflows

Particulars	Amount (Rs)
Revenue	40000
Less: Operating expenses	(7500)
	32500
Less: Commission $\left(\frac{12000}{70} \times 100\right)$	(17143)
PBDT	15357
Less: Depreciation	(9250)
PBT	6107
Less: Tax @ 30%	(1832)
PAT	4275
Add: Depreciation	9250
CFAT	13525

P.V thereof   = Rs.13525 x 5.335

                 = Rs.72156

Step 4 :- P.V Terminal Cash Inflows

= Rs.6000 x 0.467

= Rs.2802

Step 5: Calculation of NPV

NPV = Rs.72156 + 2802 – 80000

= Rs.(5042)

Part II :- Calculation of Profitability Index

$$\text{Profitability Index} = \frac{\text{P.V of CIFs}}{\text{P.V of COFs}}$$

= 74958 / 80000

= 0.937

Decision:- Based on NPV & PI it is not advisable to purchase the machinery.

PROBLEM NO: 24

Step 1: Calculation of Depreciation

Particulars	Mach X (Rs.)	Mach Y (Rs.)
Depreciation $\left[\dfrac{Cost-SV}{Life}\right]$	30000 $\dfrac{150000-0}{5yrs}$	40000 $\dfrac{240000-0}{6}$

Step 2: Calculation of PAT & CFAT

Particulars	Mach X (Rs.)	Mach Y (Rs.)
Annual Savings		
i) Savings in wages	90000	120000
ii) Savings in scrap	10000	15000
Total Savings (A)	100000	135000
Annual estimated Cost		
i) Indirect material	6000	8000
ii) Maintenance Cost	7000	11000
iii) Supervision Cost	12000	16000
Total Cost (B)	25000	35000
Annual Savings (A-B)	75000	100000
Less: Depreciation	(30000)	(40000)
PBT	45000	60000
Less: Tax @ 30%	(13500)	(18000)
PAT	31500	42000
Add: Depreciation	30000	40000
CFAT	61500	82000

Step 3: Calculation of Average Investments

Particulars	Mach X (Rs.)	Mach Y (Rs.)
Average Investment[1/2(cost)]	75000 ½(150000)	120000 ½(240000)

Step 4: Calculation of ARR

Particulars	Mach X	Mach Y
ARR = $\dfrac{Average\ PAT}{Average Investment}$	42% $\dfrac{31500}{75000}$ x 100	35% $\dfrac{42000}{120000}$ x 100

Decision: Machine 'X' is better to opt

Part – II Calculation of P.I

Particulars	Mach X	Mach Y
i) P.V of Cash Outflows (Rs.)	150000	240000
ii) P.V of Cash Inflows (Rs.)	233085 (61500 x 3.79)	357028 (82000 x 4.354)
P.I = ii/i	1.5539 $\left(\dfrac{233085}{150000}\right)$	1.4876 $\left(\dfrac{357028}{240000}\right)$

Decision: Machine 'X' is better to opt

PROBLEM NO: 25

Evaluation of given Options based on NPV

Option	Cash Outflow (Rs.)	NPV (Rs.)
A Only	100000	125000
B Only	150000	45000
C Only	150000	90000
A & B	250000	200000

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. 400000

The Total NPV under this select   = Rs. 290000

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.100000 + 150000 = Rs. 250000

NPV is   (125000 + 90000)   = Rs. 215000

PROBLEM NO: 26

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

Project	Amount (cash outflows) (Rs.)	P.V of CIFS (Rs.)	NPV (Rs.)	P.I
A	300000	366000	66000	1.22
B	150000	142500	(7500)	0.95
C	350000	420000	70000	1.20
D	450000	531000	81000	1.18
E	200000	240000	40000	1.20
F	400000	420000	20000	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.1700000, but the availability is Rs.10,00,000. There is budget constraint of Rs.700000.

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	C, D & E	1,91,000 (70,000 + 81,000 + 40,000)
2	C, E, & F	1,30,000 (70,000 + 40,000 + 20,000)
3	A, E, F	1,26,000 (66,000 + 40,000 + 20 000)
4	A, C, E	1,76,000 (66,000 + 70,000 + 40,000)

PROBLEM NO: 27

Calculation of Discounted PBP

Year	CFS (Rs.)	PVF@12%	Dis CFS (Rs.)	Cum Dis CFS (Rs.)
1	900000	0.893	803700	803700
2	900000	0.797	717300	1521000
3	900000	0.712	640800	2161800
4	900000	0.636	572400	2734200
5	900000	0.567	510300	3244500
6	900000	0.507	456300	3700800
7	900000	0.452	406800	4107600
8	900000	0.404	363600	4471200

$$= 5 \text{ yrs} + \frac{255,500}{456300}$$

= 5.56 yrs.

PROBLEM NO: 28

i) Cost of Project

At 15% IRR the Sum of total cash inflows	= Cost of Project
Annual Cost Saving	= Rs. 96000
Useful Life	= 5 yrs
PVAF @ 15%	= 3.533
PV of Cash inflows @ 15%	= Rs. 96000 x 3.533
	= Rs. 321888

Hence, Cost of Project = 321888

ii) Payback Period

$$\text{Pay back period} = \frac{Cost\,of\,Pr\,oject}{Annual\,Cost\,Savings}$$

$$= \frac{321888}{96000}$$

$$= 3.353 \text{ years.}$$

iii) Net Present Value

$$= \text{PV of CI} - \text{Cost of Project}$$

$$= *337982.40 - 321888 = 16094.4$$

iv) Cost of Capital

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

$$1.05 = X/321888$$

$$\therefore X = 321888 \times 1.05$$

$$= 337982.40*$$

Since, Annual Cost Saving = 96000

Hence, Cumulative Discount factor for 5 yrs = $\dfrac{337982.40}{96000}$

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: 29

Step 1: Calculation of Incremental Depreciation

Particulars	Amount (Rs.)
Dep on New machine $\left[\dfrac{10L - 0.4L}{8}\right]$	120000 (per annum)
Dep on Old machine $\left[\dfrac{330000}{11}\right]$	30000 (per annum)
Incremental Dep	90000 (per annum)

Step 2: Calculation of P.V of Incremental initial cash outflow

Particulars	Amount (Rs.)
Cost of New machine	1000000
Less: Sale proceeds of existing machine	(200000)
Net incremental initial Cash Outflows	800000

Step 3: Calculation of P.V of incremental Operating Cash inflows

Particulars	Amount (Rs.)
Incremental No.of units	45000 Units
Incremental sales Revenue @ 15/- p.u	675000
Less: Cost of Operation	
Material @ 4 per unit 180000	
Labour (3000 x 70 – 3000 x 40) 90000	(270000)
Incremental Contribution	405000
Less: Indirect Cash Cost	(15000)
Incremental PBDT	390000
Less: Incremental Depreciation	(90000)
Incremental PBT	300000
Less: Tax @ 30%	(90000)
Incremental PAT	210000
Add: Depreciation	90000
Incremental CFAT	300000

P.V thereof = Rs.300000 x 4.968

= Rs.1490400

Step 4: Calculation of P.V of incremental terminal Cash inflows

Rs.40000 x 0.404 = Rs.16160

Step 5: Calculation of Incremental NPV

Incremental NPV   = Rs.1490400 + 16160 – 800000

= Rs.706560

Step 6: Decision making

Since incremental NPV is +ve, it is advisable replace the existing machine with new machine.

Alternative: Refer Practice Manual Q.NO: 18

PROBLEM NO: 30

From the given information Company has the following two options to replace the existing machine.

Option – I: Continuing the existing machine for two more years and replacing then

Option – II: Replacing the existing machine with new machine as of now.

Step 1 **Calculation of NPV for Option – I**

Year	CFS (Rs.)	PVF@10%	P. values (Rs.)
1	50000	0.909	45450
2	30000	0.826	24780
2nd	60000	0.826	49560
			119790

Equivalent Annual Value   = 119790/1.735

= 69043

Step 2: Calculation of equivalent annual Cash inflows for Option – II

Year	CFS (Rs.)	PVF@10%	P. values (Rs.)
0	70000	1	(70000)
1	90000	0.909	81810
2	90000	0.826	74340
3	90000	0.751	67590
			153740

Equivalent Annual Value   = Rs. 153740/2.486

= Rs. 61842

Conclusion: Option I is better to opt due to higher equivalent annual value

PROBLEM NO: 31

Calculation of PBP for Mach X & Mach Y

Step 1 :- Calculation of Operating CIFs

Particulars	Machine X (Rs.)	Machine Y (Rs.)
Savings		
i) Savings in Cost	500	800
ii) Savings in wages	6000	8000
Total Savings (A)	6500	8800
Costs		
i) Cost of Maintenance	800	1000
ii) Cost of Supervision	1200	1800
Total Costs (B)	2000	2800
Net Savings	4500	6000

Step 2: Initial Investment

Particulars	Machine X (Rs.)	Machine Y (Rs.)
Cost of mach	9000	18000

Step 3: Payback Period

Particulars	Machine X	Machine Y
Payback Period $= \dfrac{\text{Initial cash outflow}}{\text{annual cash inflow}}$	2 yrs $\left[\dfrac{9000}{4500}\right]$	3 yrs $\left[\dfrac{18000}{6000}\right]$

PROBLEM NO: 32

From the given information Company has the following two Options.

Option –I:- Replacing Mach Z with Mach X

Option – II:- Replacing Mach Z with Mach Y

Calculation of Incremental NPVs for Option – I & Option – II

Step 1:- Calculation of P.V of Incremental Depreciation

Particulars	Option –I (Rs.)	Option – II (Rs.)
Depreciation on New machine	33000 $\left[\dfrac{180000-15000}{5}\right]$	36400 $\left[\dfrac{200000-18000}{5}\right]$
Depreciation on Old Machine $\left[\dfrac{100000-10000}{5}\right]$	18000	18000
Incremental Depreciation	15000	18400

Step 2: Calculation of P.V of Incremental initial Cash Outflows

Particulars	Option –I (Rs.)	Option – II (Rs.)
Cost of New machine	180000	200000
Less: Nsp on sale of Old machine	(110000)	(110000)
Incremental initial Cash Outflows	70000	90000

Step 3: Calculation of P.V of Operating Cash Inflows

Particulars	Option –I (Rs.)	Option – II (Rs.)
Incremental Contributions (wn-1)	24000	68000
Less: Inc. Fixed Cost (Inc. Annual F.C – Inc. Dep.)	(1000)	(21600)
Incremental PBDT	23000	46400
Less: Incremental Depreciation	(15000)	(18400)

Incremental PBT		8000	28000
Less: Tax @ 50%		(4000)	(14000)
Incremental PAT		4000	14000
Add: Incremental Depreciation		15000	18400
Incremental CFAT		19000	32400
PVAF @ 10%		3.79	3.79
P. values		72010	122796

Note: Calculation of Incremental Contribution

Particulars	Z	X	Y
No.of hours p.a	2000	2000	2000
No.of units p.h	8	8	12
Total No.of units p.a	16000	16000	24000
Contribution per unit (Rs.)	7 (20-10-3)	8.5 (20-10-1.50)	7.50 (20-10-2.50)
Total Contribution (Rs.)	112000	136000	180000

Step 4:- Calculation of P.V of Incremental Terminal Cash Inflows

Particulars	Option-I (Rs.)	Option-II (Rs.)
Nsp on Sale of New machine	15000	18000
Less: Nsp on Sale of Old machine	10000	10000
Incremental Nsp	5000	8000
PVF @ 10%	0.621	0.621
Present values	3105	4968

Step 5 :- Calculation of Incremental NPV

Particulars	Option-I (Rs.)	Option-II (Rs.)
	(72010+3105–70000)	(122796+4968-90000)
Incremental NPV	5115	37764

Step 6:- Since Incremental NPV of Option - II is more than Incremental NPV of Option - I, it is advisable to replace the Machine Z with Machine X.

PROBLEM NO: 33

Step 1: Calculation of NPV for Proposal X & Proposal Y

		Proposal X (Rs.)		Proposal Y (Rs.)	
Year	PVF @10%	CFS (Rs.)	P. values	CFS (Rs.)	P. values (Rs.)
0	1	(10000)	(10000)	(30000)	(30000)
1	0.909	5000	4545	14000	12726
2	0.826	6000	4956	19000	15694
3	0.751	4000	3004	10000	7510
			2505		5930

Step 2: Calculation of IRR for Proposal X & Proposal Y

		NPV at 1st guess rate 24%		NPV at 2nd guess rate 25%	
Year	CFS (Rs.)	PVF @ 24%	P. values (Rs.)	PVF @25%	P. values (Rs.)
0	(10000)	1	(10000)	1	(10000)
1	5000	0.806	4030	0.800	4000
2	6000	0.650	3900	0.640	3840
3	4000	0.524	2096	0.512	2048
			26		(112)

$$IRR = L_1 + \frac{NPV \, at \, L_1}{NPV \, at \, L_1 - NPV \, at \, L_2}(L_2 - L_1)$$

$$= 24\% + \frac{26}{26+112}(25\% - 24\%) = 24.19\%$$

IRR for Proposal Y

		NPV at 1st guess rate21%		NPVat 2nd guess rate22%	
Year	CFS (Rs.)	PVF @ 21%	P. values (Rs.)	PVF @22%	P.values (Rs.)
0	(30000)	1	(30000)	1	(30000)
1	14000	0.826	11564	0.820	11480
2	19000	0.683	12977	0.672	12768
3	10000	0.564	5640	0.551	5510
			181		(242)

$$IRR = 21\% + \frac{181}{181+242}(22\% - 21\%)$$

$$= 21.5\%$$

Step 3:- Decision making

	Proposal X	Proposal Y
NPV (Rs.)	2509	5943
IRR	24.19%	21.5%

From the above it is observed that based on NPV it is advisable to accept Proposal y and based on IRR it is advisable to accept Proposal X. Therefore there is a Conflict between NPV & IRR

Reasons

$\rightarrow$ Given Projects are mutually exclusive Projects

$\rightarrow$ There is a Size disparity.

Decision:-

Since the Objective of F.M is maximization of Wealth available to SHs, it is advisable to select the Project Suggested by NPV, as NPV fulfills that Objective.

$\therefore$ Select Proposal Y.

PROBLEM NO: 34

Step 1: Calculation of NPV for Project P & Project j

Year	PVF @ 15%	Project P (Rs.)		Project j (Rs.)	
		CFS	P. values	CFS	P. values
0	1	(40000)	(40000)	(20000)	(20000)
1	0.8696	13000	11304	7000	6087
2	0.7561	8000	6049	13000	9830
3	0.6575	14000	9206	12000	7890
4	0.5718	12000	6861	-	-
5	0.4972	11000	5469	-	-
6	0.4323	15000	4686	-	-
			5376		3807

Step 2: Calculation of IRR for Project P & Project j

IRR for Project P

Year	CFS (Rs.)	NPV at 1st guess rate 18%		NPV at 2nd guess rate 20%	
		PVF @ 18%	P. values (Rs.)	PVF @ 20%	P. values (Rs.)
0	(40000)	1.00	(40000)	1.00	(40000)
1	13000	0.8475	11017	0.8333	10833
2	8000	0.7182	5746	0.6944	5555
3	14000	0.6086	8520	0.5787	8102
4	12000	0.5158	6190	0.4823	5788
5	11000	0.4371	4808	0.4019	4421
6	15000	0.3704	5556	0.3349	5023
	NPV		1837		(277)

$$IRR = 18\% + \frac{1837}{1837 + 277}(20\% - 18\%) = 19.73\%$$

IRR for Project J

Year	CFS (Rs.)	NPV at 1st guess rate 24%		NPV at 2nd guess rate 26%	
		PVF @24%	P. values (Rs.)	PVF @ 26%	P. values (Rs.)
0	(20000)	1	(20000)	1	(20000)
1	7000	0.8065	5645	0.7937	5556
2	13000	0.6504	8455	0.6290	8777
3	12000	0.5245	6294	0.49999	5999
			394		(268)

$$IRR = 24\% + \frac{394}{394 + 268}(26\% - 24\%)$$

$$= 25.20\%$$

Step 3: Decision making

Particulars	Project P	Project J
NPV (Rs.)	5376	3807
IRR	19.73%	25.20%

NPV Suggesting Project P, IRR Suggesting Project J. Therefore there is Conflict between NPV & IRR.

Reasons for Conflict

i) Given Projects are mutually exclusive Projects

ii) There is a Life disparity.

So, equivalent annual value computation required due to different lifes of projects.

Equivalent annual value for:

Project P - $\frac{5375}{3.7845}$ = Rs.1420

Project J - $\frac{3807}{2.28}$ = Rs.1667

Decision

Ultimately select the Project Suggested by NPV's because the objective of F.M is maximization of wealth available to Shareholders & NPV fulfills this Object. So, select Project J as equivalent annual value for project J is greater than Project P.

So, Project J is recommended

PROBLEM NO: 35

From the given information

Particulars	Project C	Project D
NPV (Rs.)	4139	3823
IRR	26.5%	37.6%

From the above

NPV Suggesting Project C, IRR Suggesting Project D

Therefore there is a Conflict between NPV & IRR

Reasons

→ Given Projects are mutually exclusive project

→ There is Cash flows disparity

Decision: Whenever there is a Conflict between NPV & IRR it is advisable to select the Project Suggested by NPV, because the objective of FM is maximize of wealth available to shareholders, and NPV fulfills the Objective

$\therefore$ Select Project C.

PROBLEM NO: 36

Step 1: Calculation of Depreciation

Depreciation = $\dfrac{\text{Cost} - \text{S.V}}{\text{Life}}$

= 200000 x 20%

= 40000

Step 2: Calculation of P.V of initial Cash Outflow

Cost of Project = 200000

Step 3: Calculation of PAT, CFAT and P.V of CFAT   (Amount in Rs.)

Particulars	Y_1	Y_2	Y_3	Y_4	Y_5
PBT (given)	85000	100000	80000	80000	40000
Less: Tax @ 30%	(25500)	(30000)	(24000)	(24000)	(12000)
PAT	59500	70000	56000	56000	28000
Add: Depreciation	40000	40000	40000	40000	40000
CFAT	99500	110000	96000	96000	68000
PVF @	0.909	0.826	0.751	0.683	0.621
P. values	90445	90860	72096	65568	42228

P.V of Operating cash Inflows = 361197

Step 4: P.V of Terminal Cash Inflows

P.V of Terminal Cash inflows = 0

Step 5:

i) Calculation of ARR

ARR = $\dfrac{\text{AvgPAT}}{\text{AvgInvest}}$

= $\dfrac{(59500 + 70000 + 56000 + 28000) \div 5}{(200000) \times 1/2}$

= 53900/100000 x 100

= 53.90%

ii) Calculation of PBP

Initial Investment = 200000

Year	CFAT (Rs.)	Cum CFAT (Rs.)
1	99500	99500
2	110000	209500
3	96000	305500
4	96000	401500
5	68000	469500

PBP   = 1 yrs + $\dfrac{100500}{110000}$

= 1.914 years

iii) Calculation of NPV

NPV   = 361197 + 0 − 200000

        = 161197

iv)Calculation of IRR

Year	CFS (Rs.)	NPV at 1st guess rate38%		NPV at 2nd guess rate 40%	
		PVF@38%	P. values (Rs.)	PVF @ 40%	P. values (Rs.)
0	(200000)	1	(200000)	1	(200000)
1	99500	0.725	72,137	0.714	71,043
2	110000	0.525	57,950	0.510	56,100
3	96000	0.381	36,576	0.364	34,944
4	96000	0.276	26,496	0.260	26,960
5	68000	0.200	13,600	0.186	12,648
			6,559		(305)

$$IRR = 38 + \frac{6559}{6559 + 305} (40\% - 38\%) = 39.91\%$$

PROBLEM NO: 37

a)

(i) Calculation of PBP

Project A = $\frac{10,000}{10,000}$ = 1 year

Project B = $\frac{10,000}{7500}$ = 1.33 years

Project C = 2years + $\frac{4000}{12,000}$ = 2.33 years

Project D = 1 year

(ii) Calculation of ARR

Project A = $\frac{10000 - 10000}{10000 / 2}$ = 0

Project B = $\frac{(15000 - 10000)1/2}{10000 \times 1/2}$ = 2500/5000 x 100 = 50%

Project C = $\frac{(18000 - 10000)1/3}{10000 \times 1/2}$ = 2667/5000 x 100 = 53%

Project D = $\frac{(16000 - 10000)1/3}{10000 \times 1/2}$ = 2000/5000 x 100 = 40%

Note: This net cash proceeds include investment also Therefore, net earnings are found by deducting Initial investment.

iii) Calculation of IRR

Project A

The net Cash Proceeds in years are just equal investment

∴ r = 0%

Project B

Annual Cash flow   = Rs. 7500

P.V of Cash Outflows   = Rs.10000

∴ PVAF = 10000/7500   = 1.33

This factor is found under 32% Column

∴ r = 32%

Project C

Year	CFS (Rs.)	NPV at 1ˢᵗ guess rate 26%		NPV at 2ⁿᵈ guess rate 27%	
		PVF @ 26%	P. values (Rs.)	PVF @ 27%	P. values (Rs.)
0	(10000)	1	(10000)	1	(10000)
1	2000	0.794	1588	0.787	1574
2	4000	0.630	2520	0.620	2480
3	12000	0.500	6000	0.488	5856
			108		- 86

$$\text{IRR} = 26\% + \frac{105}{105+86}(27\% - 26\%)$$

$$= 26.5\%$$

Project D

Year	CFS (Rs.)	NPV at 1ˢᵗ guess rate 37%		NPV at 2ⁿᵈ guess rate 38%	
		PVF @ 37%	P. values (Rs.)	PVF @ 38%	P. values (Rs.)
0	(10000)	1	10000	1	(10000)
1	10000	0.730	7300	0.725	7250
2	3000	0.533	1599	0.525	1575
3	3000	0.389	1167	0.381	1143
			66		32

$$\text{IRR} = 37\% + \frac{66}{66+32}(38\% - 37\%)$$

$$= 37.6\%$$

Calculation of NPV @ 10%

NPV = present value of cash inflows – pv of cash out flow

Project A

= 10000 x (0.909) – 10000

= - 910

Project B

= 7500 x 1.735 – 10000

= 3103

Project C

Year	CFS (Rs.)	PVF @ 10%	P. values (Rs.)
0	(10000)	1	(10000)
1	2000	0.909	1818
2	4000	0.826	3304
3	12000	0.751	9012
NPV			4134

Project D

Year	CFS (Rs.)	PVF @ 10%	P. values (Rs.)
0	(10000)	1	(10000)
1	10000	0.909	9090
2	3000	0.826	2478
3	3000	0.751	2253
NPV			3821

NPV at 30%

Project A

= 10000 x 0.769 – 10000 = - 2310

Project B

= (7500 x 1.361) – 10000 = + 208

Project C

Year	CFS (Rs.)	PVF @ 30%	P.values (Rs.)
0	(10000)	1	(10000)
1	2000	0.769	1538
2	4000	0.592	2368
3	12000	0.455	5460
			- 634

Project D

Year	CFS (Rs.)	PVF @ 30%	P. values (Rs.)
0	(10000)	1	(10000)
1	10000	0.769	7690
2	3000	0.592	1776
3	3000	0.455	1365
			831

Ranking

Project	Based on PBP	Based on ARR	Based on IRR	Based on NPV @ 10%	Based on 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) **Conclusion:** NPV rule generally gives consistent results in conformity with wealth maximization principle. Therefore Project C to be accepted at discount @ 10%.

PROBLEM NO: 38

i) **Calculation of NPV**

Year	PVF @ 10%	Machine A (Rs.)		Machine B (Rs.)	
		CFS	P. values	CFS	P. values
0	1	(400000)	(400000)	(400000)	(400000)
1	0.909	40000	36360	120000	109080
2	0.726	120000	99120	160000	132160
3	0.751	160000	120160	200000	150200
4	0.683	240000	163920	120000	81960
5	0.621	160000	99360	80000	49680
			118920		123080

ii) **Calculation of PBP**

Machine A

Year	Cash flows (Rs.)	Cum CFS (Rs.)
1	40000	40000
2	120000	160000
3	160000	320000
4	240000	560000
5	160000	720000

= 3 yrs + 80000/240000

= 3.33 yrs

= 3 yrs 4 months

Machine B

Year	CFS (Rs.)	Cum CFS (Rs.)
1	120000	120000
2	160000	280000
3	200000	480000
4	120000	600000
5	80000	680000

= 2 yrs + 120000/200000

= 2.6 yrs

= 2 yrs 7.2 months

iii) Calculation of Annual Rate of Return

Machine A

$$ARR = \frac{(720000 - 400000) \div 5}{400000} \times 100$$

$$= 16\%$$

Machine B

$$ARR = \frac{(680000 - 400000) \div 5}{400000} \times 100$$

$$= 14\% \text{ yrs}$$

Decision: As NPV of Machine B is greater than Machine A it is preferable to adopt alternative machine B.

PROBLEM NO: 39

(a) Pay back period

A = 5+ (500/900) = 5.56 years

B = 5 + (500/1200) = 5.42 years

C = 2 + (1,000/2000) = 2.5 years

Net present Value

NPV_A = (-5,000) + (900 X 6.145) = (5,000) + 5,530.5 = 530.5

NPV_B is calculated as follows:

year	Cash flow (Rs.)	10% discount Factor	Present Value (Rs.)
0	(5,000)	1.000	(5,000)
1	700	0.909	636
2	800	0.826	661
3	900	0.751	676
4	1,000	0.683	683
5	1,100	0.621	683
6	1,200	0.564	677
7	1,300	0.513	667
8	1,400	0.467	654
9	1,500	0.424	636
10	1,600	0.386	618
			1591

NPV$_C$ is calculated as follows:

Year	Cash flow (Rs.)	10% discount Factor	Present Value (Rs.)
0	(5,000)	1.000	(5,000)
1	2,000	0.909	1,818
2	2,000	0.826	1,652
3	2,000	0.751	1,502
4	1,000	0.683	683
			655

Internal rate of return

NPV at 12% = (5,000) + 900 X 5.650

= (5,000) + 5085 = 85

NPV at 13% = (5,000) + 900 X 5.426

= (5,000) + 4,883.40 = -116.60

$$IRR_A = 12 + \left(\frac{85}{85 + 116.60} \right) \times (13-12) = 12 + 0.42$$

IRR$_A$ = 12.42%.

IRR$_B$

Year	Cash flow(Rs.)	10% discount factor	Present value	20% discount factor	Present Value (Rs.)
0	(5,000)	1.000	(5,000)	1.000	(5,000)
1	700	0.909	636	0.833	583
2	800	0.826	661	0.694	555
3	900	0.751	676	0.579	521
4	1,000	0.683	683	0.482	482
5	1,100	0.621	683	0.402	442
6	1,200	0.564	677	0.335	402
7	1,300	0.513	667	0.279	363
8	1,400	0.467	654	0.233	326
9	1,500	0.424	636	0.194	291
10	1,600	0.386	618	0.162	259
			1591		(776)

Interpolating: IRR$_B$ = 10% + $\left(\frac{1,591}{1591 + 776} \right)$ x (20% -10%) = 10% + 6.72% = 16.72%

IRR$_C$

Year	Cash flow(Rs.)	15% discount factor	Present value	18% discount factor	Present Value (Rs.)
0	(5,000)	1.000	(5,000)	1.000	(5,000)
1	2,000	0.870	1,740	0.847	1,694
2	2,000	0.756	1,515	0.718	1,436
3	2,000	0.658	1,316	0.609	1,218
4	1,000	0.572	572	0.516	516
			140		(136)

Interpolating: IRR$_c$ = 15% + $\left(\frac{140}{140 + 136} \right)$ x (18% -15%) = 15% + 1.52% = 16.52%

Accounting Rate of Return

ARR$_A$ = Average capital employed = $\frac{5,000}{2}$ = Rs. 2,500.

Average accounting profit = $\dfrac{(9000 - 5000)}{10}$ = Rs. 400

$ARR_A = \dfrac{(400 \times 100)}{2,500}$ = 16%

ARR_B: Average accounting profit = $\dfrac{11,500 - 5,000}{10}$ = Rs. 650

$ARR_B = \dfrac{(650 \times 100)}{2,500}$ = 26%

ARR_c = Average accounting profit = $\dfrac{(7,000 - 5,000)}{4}$ = Rs.500

$ARR_c = \dfrac{500 \times 100}{2,500}$ = 20%

(b) Summary statement

Project	A	B	C
Payback (years)	5.5	5.4	2.5
ARR	16	26	20
IRR	12.42	16.72	16.52
NPV	530.50	1,591	655

Comparison of Ranking:

Method	Payback	ARR	IRR	NPV
1	C	B	B	B
2	B	C	C	C
3	A	A	A	A

PROBLEM NO: 40

Year	PVF @ 16%	Project A (Rs.) Cash flows	Project A (Rs.) P. values	Project B (Rs.) CFS	Project B (Rs.) P. values
0	1.000	(135000)	(135000)	(240000)	(240000)
1	0.862	-	0	60000	51720
2	0.743	30000	22290	84000	62412
3	0.641	132000	84612	96000	61536
4	0.552	84000	46368	102000	56304
5	0.476	84000	39984	90000	42840
			58254		34812

Discounted PBP

Project A

Year	Disc CFS (Rs.)	Cum Dis CFS (Rs.)
1	0	0
2	22290	22290
3	84612	106902
4	46368	153270
5	39984	193254

= 3 yrs + 28098/46368

= 3.61 yrs

Project B

Year	Dis CFS (Rs.)	Cum Dis CFS (Rs.)
1	51720	51720
2	62412	114256
3	61536	175792
4	56304	232096
5	42840	274812

= 4 yrs + 7904/42480

= 4.19 yrs

Profitability Index

Project A = 193254 / 135000 = 1.43

Project B = 274812 / 240000 = 1.15

THE END