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 $\left[\dfrac{1}{2}(\cos t - sv) + sv + w.cap\right]$	30000 $\left[\dfrac{1}{2}(50000-2000)+2000+4000\right]$	40000 $\left[\dfrac{1}{2}(50000-2000)+2000+14000\right]$
iii) iii) Avg PAT	15000 $\left[\dfrac{5k+10k+15k+20k+25k}{5}\right]$	15000 $\dfrac{PVCOF}{PVAF(2,9\%)}$
iv) iv) ARR (iii ÷ ii)	50% $\left[\dfrac{15000}{30000}\times100\right]$	37.5% $\left[\dfrac{15000}{40000}\times100\right]$

PROBLEM NO: 2

	Year 1	Year 2	Year 3	Year 4
Profit before Interest and Tax	10,000	20,000	40,000	50,000
Less: Interest	5,000	5,000	5,000	5,000
	5,000	15,000	35,000	45,000
Less: Tax @ 30%	1,500	4,500	10,500	13,500
Profit after Tax (PAT)	3,500	10,500	24,500	31,500
Add: Interest (1- t)	3,500	3,500	3,500	3,500
PAT excluding financing cost	7,000	14,000	28,000	35,000

PROBLEM NO: 3

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: 4

Calculation of CFAT
        (Amount in Rs.)

Particulars	y1	y2	y3	y4
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: 5

Working notes 1:

Calculation of depreciation:

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

Working notes 2:

Estimation of Cashflow After Tax

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Cash flow before Dep & tax	1,00,000	1,00,000	1,50,000	1,50,000	2,50,000
Less: Dep	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: Dep	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)	Cumm. 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

Pay back period = $\text{Covered Year} + \dfrac{\text{Uncovered Amount}}{\text{Next year CFAT}}$

$4^{th} \text{year} + \dfrac{55,000}{1,67,500} = 4.32 \text{years}$

PROBLEM NO: 6

a) Calculation of pay back period

Project	Cash Flows (Rs. 000)					Pay back period
	C0	C1	C2	C3	C4	
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 pay back period is 2 Years : since actual pay back period i.e (3 years) is more than the standard pay back period i.e (2 years) , we should reject all the three projects.

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

PROBLEM NO: 7

Step 1: Calculation of depreciation:

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

$$= \frac{110,00,000 - 10,00,000}{10\ years} = 10,00,000$$

Step 2: Calculation of CFAT

	1 – 10 Years
Cash flow after tax	10,00,000
Add: Depreciation	10,00,000
CFAT	20,00,000

PV of Cash inflow = CFAT x PVAF(10years,12%)

= 20,00,000 x 5.651 = 1,13,02,000

Step 3: Calculation of terminal cash inflow

Particulars	Amount (Rs. In lacs)
Gross Sale (A)	10
Less: Book value	10
Capital Gain	-
Capital gain tax@55%(B)	-
terminal cash inflow (A) – (B)	10
PV of terminal cash inflow= (PV F x terminal cash imflow)	(0.322 x 10) = 3.22

Step 4: Calculation of NPV

NPV = PV of cash Inflow + PV of Terminal Cash Inflow – PV of Cash Outflow

= 1,13,02,000 + 3,22,000 – 110,00,000

= 6,24,000

PROBLEM NO: 8

Computation of initial cash outlay

	(Rs. In Lakhs)
Equipment cost	120
Additional equipment cost purchased at the end of the 2nd year (10lacs x 0.797)	7.97
Working capital	15
Pv. Of Cash outlfows	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			
Initial Outlay	1,75,00,000	1.000	1,75,00,000
Additional Investment	10,00,000	0.797	7,97,000
(B)			1,82,97,000
Net Presesnt Value (NPV) (A-B)			90,24,450

Recommendation: Accept the project in view of positive NPV

PROBLEM NO.9

Working Notes:

1) **Annual Depreciation of Machines**

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

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

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

2) **Calculation of Cash Inflows**
   Machine "MX":

Particulars	Y1	Y2	Y3	Y4	Y5	Y6
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	Y1	Y2	Y3	Y4	Y5	Y6
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. + $\dfrac{8,00,000 - 7,58,000}{1,65,000}$ = 4 Years. + 0.25

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

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

Following Costs are to be ignored while computing incremental CFAT

a) Research cost = Rs.,60,000 – SUNK COST

b) Disposal cost of Rs.10,000 gallons of waste material – COMMON COST

c) Allocation of Administrative overheads – COMMON COST

Working Note 1:- Depreciation p.a. = $\dfrac{\text{Cost} - \text{scrap}}{\text{life}} = \dfrac{6,00,000 - 0}{10}$ = Rs.60,000

Calculation of Net Present Value using Incremental approach

Step – 1: - Calculation of Present Value of Cash Outflows

Particulars	Amount
Cost of new equipment	6,00,000
Research Cost	-
Present value of Cash Outflow	6,00,000

Step – 2: - Calculation of Present Value of Operating Cash inflows per year.

Particulars	Amount (Rs.)	Amount (Rs.)
Savings:		
i) Disposal cost	40,000 x 1	40,000
ii) Sales Revenue	40,000 x 10	4,00,000
Less: Incremental Cost		
i) Advertisement		20,000
ii) Variable Cost	40,000 x 5	2,00,000
iii) Fixed Cost		30,000
PBDT		**1,90,000**
Less: Depreciation	Working Note – 1	60,000
PBT		**1,30,000**
Less: Tax @ 35%	1,30,000 x 35%	45,500
PAT		**84,500**
Add: - Depreciation		60,000
CFAT		**1,44,500**

Present Value there of = 1,44,500 x PVAF (15%,10) = 1,44,500 x 5.019 = Rs.7.25.246

Step – 3: Present Value of Terminal Cash Inflows = 0

Step – 4: Calculation of Net Present Value

Net Present Value = 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 Outflows.

= 7,25,246 – 6,00,000

= Rs.1,25,246

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.

Conclusion: Since Net Present Value is positive, it is beneficial for the company to process the waste material rather than disposing it.

PROBLEM NO:11

Calculation of NPV

Step 1: P.V of initial cash outflows = 200 L

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

Particulars	y1	y2	y3	y4	y5
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: 12

Step 1 Calculation of Depreciation

Particulars	y1 to y2	y3 to y8
Depreciation on initial equipment	17.5L $\left[\dfrac{140-0}{8}\right]$	17.5L
Depreciation on additional equipment $\left[\dfrac{10-1}{6}\right]$	-	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	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: 13

Step 1: Calculation of Depreciation for both the projects

	Project X	Project Y
Cost of the project	120 lacs	120 lacs
Salvage value	-	-
Estimated use full life	8 Years	6Years
Depreciaton	15 lacs	20 lacs

Step 2: Calculation of NPV

Years	PVF @ 15%	Project X		Project Y	
		Cash inflows	PV Cash flows	Cash inflows	PV Cash flows
0	1.00	(120)	(120)	(120)	(120)
1	0.870	25	21.75	40	34.8
2	0.756	35	26.46	60	45.36
3	0.658	45	29.61	80	52.64
4	0.572	65	37.18	50	28.6
5	0.497	65	32.31	30	14.91
6	0.432	55	23.76	20	8.64
7	0.376	35	13.16	-	-
8	0.327	15	4.91	-	-
	4.488		NPV =69.14		NPV = 64.95

Step 3: Calculation of Annualized NPV:

$$\text{Project X} = \frac{NPV}{PVAF(r,n)} = \frac{69.14}{PVAF(15\%,8 years)} = \frac{69.14}{4.488} = \textbf{15.4 lacs}$$

$$\text{Project Y} = \frac{NPV}{PVAF(r,n)} = \frac{64.95}{PVAF(15\%,6 years)} = \frac{64.95}{3.785} = \textbf{17.16 lacs}$$

PROBLEM NO: 14

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

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

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

$$= Rs. 100314$$

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: 15

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: 16

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: 17

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: 18

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: 19

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: 20

i) Project A

Year	CFS (Rs.)	NPV at 1st guess rate 11%		NPV at 2nd guess rate12%	
		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

year	CFS (Rs.)	NPV at 1st guess rate 10%		NPV at 2nd guess rate 11%	
		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: 21

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: 22

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

Particulars	Y1	Y2	Y3	Y4	Y5
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)**

Year	CFS (Rs.)	NPV at 1st guess rate 14%		NPV at 2nd guess rate 16%	
		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: 23

Calculation of CFAT (Amount in Rs.)

Particulars	Y_1	Y_2	Y_3	Y_4	Y_5
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.)

Year	CFS	At 11% PVF	At 11% P values	At 12% PVF	At 12% P values	At 13% PVF	At 13% P values	At 14% PVF	At 14% P values	At 15% PVF	At 15% 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 **Rs.310500** is matched with present value at 14%, return of project = 14%

Therefore, return of project = 14%

PROBLEM NO: 24

Part I: Calculation of NPV

Step 1: Calculation of Depreciation

$$\text{Depreciation (Rs.)} = \frac{Cost - salvage\,value}{Estimated\,life}$$

$$= \frac{80,000 - 6000}{8}$$

= 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 $\left(\dfrac{12,000}{70} \times 100\right)$	(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

Profitability Index $= \dfrac{P.V \, of \, CIFs}{P.V \, of \, COFs}$

= 74958 / 80000

= 0.937

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

PROBLEM NO: 25

Step 1: Calculation of Depreciation

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

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 = $\dfrac{\text{Average PAT}}{\text{Average Investment}}$	42% $\dfrac{31500}{75000} \times 100$	35% $\dfrac{42000}{120000} \times 100$

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: 26

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: 27

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: 28

Discounted Payback Period (Cash flows discounted at 10%)

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

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

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

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

C -3500 + 1,363.65 + 2,066 + 375.65 + 5,122.50

$$2\,Years + \frac{12}{375.65} \times 70.35 = 3\,years\,and\,4.6\,months$$

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

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

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: 29

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. 96000 x 3.533
	= Rs. 321888
Hence, Cost of Project	= 321888

ii) **Payback Period**

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

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

$$= 3.353\;years.$$

iii) __Net Present Value__

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

$$= *337982.40 - 321888 = 16094.4$$

iv) __Cost of Capital__

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

$$1.05 = X/321888$$

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

$$= 337982.40*$$

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: 30

Cash outflow

	Rs.
Cost of new machine	2,50,000.00
Less: Sale of old machine	50,000.00
Less: Tax saving from loss due to sale of old machine Rs.40,000(Rs.9*0,000 – RS.50,000)* × 50%	20,000.00
Net Cash Outflow	1,80,000.00

	Amount before tax	Amount after tax
Cost savings	30,000	15,000
Tax savings on depreciation:		
New machine	25,000	
Old machine	10,000	
Differential depreciation	15,000	
Tax savings on Rs.15,000 @ 50%		7,500
Cash flow after tax (1 to 8 years)		22,500
Salvage value of new machine (9th year)		25,000
Cash flow after tax (9th year)		47,500

Determination of Net Present Value

Year	Cash in flow after tax (Rs)) (2)	Present value factor at (10%) (3)	Present value of cash inflows (Rs.) (4)=(2) X (3)
1 – 8	22,500	5.335	1,20,038
9	47,500	0.424	20,140
		Total Cash Inflow	1,40,178
		Less: Net Cash Outflow	1,80,000
		Net Present Value	(39,822)

Decision: Since the net present value is negative, the old machine should not be replaced.

PROBLEM NO: 31

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.

PROBLEM NO: 32

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.

<u>Step 1</u> 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: 33

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: 34

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: 35

a)

(i) Calculation of PBP

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

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

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

Project D = 1 year

(ii) Calculation of ARR

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

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

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

Project D = $\dfrac{(16000 - 10000)1/3}{10000 \times 1/2}$ = 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

IRR = 26% + $\dfrac{105}{105 + 86}$(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

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

$= 37.6\%$

<u>**Calculation of NPV @ 10%**</u>

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

Project A

$= 10000 \times (0.909) - 10000$

$= -910$

Project B

$= 7500 \times 1.735 - 10000$

$= 3103$

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

<u>**NPV at 30%**</u>

<u>**Project A**</u>

$= 10000 \times 0.769 - 10000 = -2310$

<u>**Project B**</u>

$= (7500 \times 1.361) - 10000 = +208$

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: 36

Step 1: Calculation of Depreciation

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

$$= 200000 \times 20\%$$

$$= 40000$$

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**

$$\text{ARR} = \frac{\text{Avg PAT}}{\text{Avg Invest}}$$

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

$$= 53900/100000 \times 100$$

$$= 53.90\%$$

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

PROBLEM NO: 37

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

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

= 16%

Machine B

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

= 14% yrs

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

PROBLEM NO: 38

Working Notes:

1. Computation of Net Present Values of Projects

Year	Cash flows		Discounting factor @ 16 %	Discounted Cash flow	
	Project A (Rs.) (1)	Project B (Rs.) (2)	(3)	Project A (Rs.) (3)×(1)	Project B (Rs.) (3) ×(2)
0	1,35,000	2,40,000	1.000	1,35,000	2,40,000
1	-	60,000	0.862	-	51,720
2	30,000	84,000	0.743	22,290	62,412
3	1,32,000	96,000	0.641	84,612	61,536
4	84,000	1,02,000	0.552	46,368	56,304
5	84,000	90,000	0.476	39,984	42,840
Net present Value				58,254	34,812

2. Computation of Cumulative Present Values of Projects Cash inflows

Year	Project A		Project B	
	PV of cash inflows	Cumulative PV	PV of cash inflows	Cumulative PV
1	-	-	51,720	51,720
2	22,290	22,290	62,412	1,14,132

3	84,612	1,06,902	61,536	1,75,668
4	46,368	1,53,270	56,304	2,31,972
5	39,984	1,93,254	42,840	2,74,812

i) Discounted payback period: *(Refer to Working note 2)*

Cost of Project A = Rs.1,35,000

Cost of Project B = Rs.2,40,000

Cumulative PV of cash inflows of Project A after 4 years = Rs.1,53,270

Cumulative PV of cash inflows of Project B after 5 years = Rs.2,74,812

A comparison of projects cost with their cumulative PV clearly shows that the project A's cost will be recovered in less than 4 years and that of project B in less than 5 years. The exact duration of discounted payback period can be computed as follows:

	Project A	Project B
Excess PV of cash inflows over the project cost (Rs.)	18,270 (Rs.1,53,270 – Rs.1,35,000	34,812 (Rs. 2,74,812 – Rs.2,40,000)
Computation of period required to recover excess amount of cumulative PV over project cost (Refer to Working note 2)	0.39 year (Rs.18,270 /Rs. 46,368)	0.81 years (Rs.34,812 / Rs.42,840)
Discounted payback period	3.61 year (4 - 0.39) years	4.19 years (5 - Rs. 0.81) years

ii) Profitability Index: $= \dfrac{\text{Sum of discount cash inflow}}{\text{Initial Cash outlay}}$

Profitability Index (for Project A) $= \dfrac{Rs.1,93,254}{Rs.1,35,000} = 1.43$

Profitability Index (for Project B) $= \dfrac{Rs.2,74,812}{Rs.2,40,000} = 1.15$

iii) Net present value *(for Project A)* = Rs.58,254

(Refer to Working note 1)
Net present value *(for Project B)* = Rs.34,812

PROBLEM NO: 39

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.,

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

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:

$$\text{Profitability Index} = \frac{\text{Present value of CashInflow}}{\text{Cost of theInvestment}}$$

$$= \frac{\text{Rs.97,92,200}}{\text{Rs.80,00,000}} = 1.224$$

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:

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

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

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

PROBLEM NO.40

CALCULATION OF PAY BACK PERIOD OF EACH PROJECT

Particulars	M – I	M – 2	M – 3
Step – 1: Calculation of Dep. P.a.	1,30,000	91,667	90,000

$\left(\dfrac{\text{Cost} - \text{Scrap Value}}{\text{Life}}\right)$	$\left(\dfrac{3,00,000 - 40,000}{2}\right)$	$\left(\dfrac{3,00,000 - 25,000}{2}\right)$	$\left(\dfrac{3,00,000 - 30,000}{2}\right)$
Step-2: Calculation of CFAT p.a.			
Sales	5,00,000	4,00,000	4,50,000
Less:			
Direct Materials	40,000	50,000	48,000
Direct Labour	50,000	30,000	36,000
Factory Overheads	60,000	50,000	58,000
Administrative Overheads	20,000	10,000	15,000
Selling and Distributive Overheads	10,000	10,000	10,000
Interest on Capital (3,00,000 x 10%)	30,000	30,000	30,000
PBDT	2,90,000	2,20,000	2,53,000
Less:			
Depreciation (Step – 1)	1,30,000	91,667	90,000
PBT	1,60,000	1,28,333	1,63,000
Less: Tax @ 40%	64,000	51,333	65,200
PAT	96,000	77,000	97,800
Add: Depreciation	1,30,000	91,667	90,000
CFAT	2,26,000	1,68,667	1,87,800
Step -3: Calculation of Pay back period	1.327yrs	1.778 yrs	1.597 yrs
$\left(\dfrac{\text{Initial Investment}}{\text{CFAT p.a.}}\right)$	$\left(\dfrac{3,00,000}{2,26,000}\right)$	$\left(\dfrac{3,00,000}{1,68,667}\right)$	$\left(\dfrac{3,00,000}{1,87,800}\right)$

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. 41

Working Notes:

W.N.1: Net Sale Procedures of machine R as on today.

GSP/NSP of Machine R as on today	1,00,000
Less: Cost of dismantling and removal	30,000
NSP of Machine R as on today	70,000

W.N.2: NSP of Machine R after 5 years

GSP/NSP of Machine R after 5 years=0

W.N.3: NSP of Machine S after 5 years

GSP/NSP of Machine S after 5 years=0

PART A- Calculation of Net Present Value Using Incremental approach

Step-1: Calculation of Net initial cash outflows

Particulars	Rs.
Cost of Machine S	2,50,000
Less: NSP of Machine R as on today (W.N-1)	70,000
P.V of Net Cash Outflows	**1,80,000**

Step-2:Calculation of Net Present Value of operating cash inflows

Particulars	Machine R	Machine S
Sales Revenue (1,50,000x Rs. 6/unit	9,00,000	9,00,000

Less: Annual operating cost	2,00,000	1,80,000
Less: Fixed Cost (@ Rs. 3/ unit	4,50,000	4,50,000
CFAT P.a.	**2,50,000**	**2,70,000**

Incremental CFAT P.a.   = 20,000 p.a. (2,70,000- 2,50,000)

P.V of operating cash inflows = 20,000x PVAF (14%,5yrs)

                        = 20,000x3.432= Rs. 68,640/-

Step-3: Present value of terminal cash inflows=0

Step-4: Calculation of Net present value

Net present value = 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 outflows

            = 68,640+ 0 – 1,80,000= -1,11,360

Assumptions:

● Cash flows are assumed to accure 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

    Conclusion: since NPV is negative, therefore machine R has to be continued without replacement

PART B- Calculation of net present value when machine R has not installed

Now machine r & S are two separate alternatives for decision making.

Step-1: Calculation of cash outflows

Particulars	Machine R	Machine S
Cost of the Machine	2,00,000	2,50,000

Step-2: Calculation of Present Value of operating cash inflows

Particulars	Machine R	Machine S
CFAT p.a	2,50,000	2,70,000
PVAF (14%, 5yrs	3.432	3.432
P.V there of	8,58,000	9,26,640

Step-3: Calculation of Present Value of Terminal cash inflows

Particulars	Machine R	Machine S
P.V of Terminal C.I	0	0

Step-4: Calculation of Net Present Value

Net present value = PV of cash inflows- PVof cash outflows

            = PV of operating cash inflows+ PV of terminal cash inflows- PV of cash outflows

Particulars	Machine R	Machine S
NPV	8,58,000-2,00,000=6,58,000	9,26,64,0-2,50,000=6,76,640

Assumptions:

● Cash flows are assumed to accure 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

    Conclusion: since NPV is negative, therefore machine R has to be continued without replacement

    Decision: since machine S has highest NPV, it has to be selected

PROBLEM NO.42

Working Notes:

Depreciation on Machine – I = $\dfrac{30,00,000}{10}$ = Rs. 3,00,000

Depreciation on Machine – II = $\dfrac{40,00,000}{10}$ = Rs. 4,00,000

Particulars	Machine-I (Rs.)	Machine-II (Rs.)
Annual Income (before Tax and Depreciation)	12,50,000	17,50,000
Less: Depreciation	3,00,000	4,00,000
Annual Income (before Tax)	9,50,000	13,50,000
Less: Tax @ 30%	2,85,000	4,05,000
Annual Income (after Tax)	6,65,000	9,45,000
Add: Depreciation	3,00,000	4,00,000
Annual Cash Inflows	9,65,000	13,45,000

Year	Machine – I				Machine - II		
	PV of Re 1 @ 15%	Cash flow	PV	Cumulative PV	Cash flow	PV	Cumulative PV
1	0.870	9,65,000	8,39,550	8,39,550	13,45,000	11,70,150	11,70,150
2	0.756	9,65,000	7,29,540	15,69,090	13,45,000	10,16,820	21,86,970
3	0.658	9,65,000	6,34,970	22,04,060	13,45,000	8,85,010	30,71,980
4	0.572	9,65,000	5,51,980	27,56,040	13,45,000	7,69,340	38,41,320
5	0.497	9,65,000	4,79,605	32,35,645	13,45,000	6,68,465	45,09,785

i) **Discounted Payback Period**

Machine – I

Discounted Payback Period $= 4 + \dfrac{(30,00,0,00 - 27,56,040)}{4,79,605}$

$= 4 + \dfrac{2,43,960}{4,79,605} = 4 + 0.5087 = 4.5087$ years or 4 years 6.10 months

Machine – II

Discounted Payback Period $= 4 + \dfrac{(40,00,000 - 38,41,320)}{6,68,465}$

$= 4 + \dfrac{1,58,680}{6,68,465} = 4 + 0.2374 = 4.2374$ years or 4 years 2.85 months

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

Machine – I

NPV = 32,35,645 - 30,00,000 = Rs. 2,35,645

Machine – II

NPV = 45,09,785 – 40,00,000 = Rs. 5,09,785

iii) **Profitability Index**

Machine – I

Profitability Index $= \dfrac{32,35,645}{30,00,000} = 1.08$

Machine – II

Profitability Index $= \dfrac{45,09,785}{40,00,000} = 1.13$

Conclusion:

Method	Machine - I	Machine - II	Machine – III
Discounted Payback Period	4.51 Years	4.24 years	II
Net Present Value	Rs.2,35,645	Rs.5,09,785	II
Profitability Index	1.08	1.13	II

THE END