

# FM Assignment 2

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Q1) Loan amt = 20000

$$\begin{array}{ccccccc} & 427.9 & 427.9 & & & & 427.9 \\ \hline 0 & 1/12 & 2/12 & \dots & \dots & \dots & 60/12 \end{array}$$

(i)  $A \cdot P \cdot R = \frac{2 \times \text{avg. annual int}}{\text{original loan}}$

From  $427.9 \times 12 = \frac{20000}{a_{\overline{5}|i}}$

we have  $i = 8.947\%$

$$\therefore S_5 = \frac{(1+i)^n - 1}{i} = 427.9 \times 12 \times 5.9783$$

$$= 30697.8568$$

$$\therefore APR = \frac{2 \times 30697.8568}{20000}$$

$$= \frac{122791.7136}{20000} = 6.13958568\%$$

(ii)  $PV_1 = 427.9 \times 12 a_{\overline{5}|i}^{(12)} @ i = 10.8\%$

$$\therefore PV_1 = 16775.97728$$

$$\therefore PV_1 = 12(274.497) a_{\overline{T}|i}^{(12)} @ 10.8\%$$

$$\therefore T = 7.25425$$

(iii) Interest paid in 1<sup>st</sup> loan = 3763.22

Int. paid in 2<sup>nd</sup> = 7104.3233

Int. paid more = 3341.43

Q2)  
i)

### a) Discounted Payback Period:-

It is a capital budgeting process used to determine profitability of a project. It gives no. of yrs. it takes to break even from undertaking initial expenditure, by discounting future cash flows and recognizing time value of money.

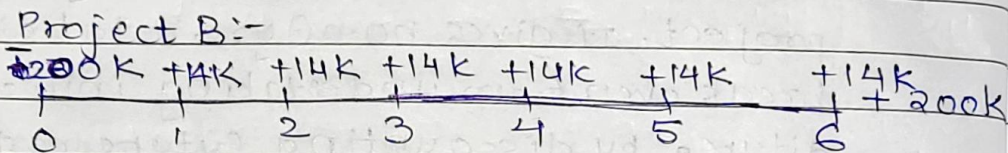
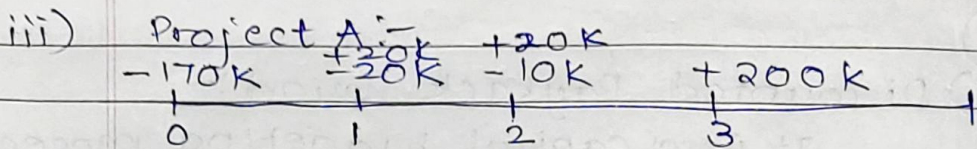
### b) Payback Period:-

It is found by counting the no. of years it takes before the cumulative forecasted cash flow equals the initial investment.

ii) DPP:- A project may have a longer discounted P.P but also a higher NPV than another, if it creates much more cash inflows after its DPP.

PP:- NPV is calculated in terms of currency while Payback Method refers to the period of time required for the return on an investment to repay the total initial investment.

- PP doesn't account for the effect of time value of money. DPP does.
- DPP uses discounted cash flows, thus is more accurate than PP.



9) IRR Project A:-

$$NPV_i \Rightarrow -170 - 20V + 20V - 10V^2 + 200V^2 + 200V^3 = 0$$

$$\Rightarrow -170 + 10V^2 + 200V^3 = 0$$

$$\Rightarrow -170 + 10(1+i)^{-2} + 200(1+i)^{-3} = 0$$

For  $i = 10\%$ ;  $RHS = -11.4725$

$i = 8\%$ ;  $RHS = -2.6601$

$i = 7\%$ ;  $RHS = 1.9939$

$$\therefore \frac{x - 7\%}{8\% - 7\%} = \frac{0 - 1.9939}{-2.6601 - (-1.9939)}$$

$$\therefore x = 9.9929\%$$

$$\therefore \text{IRRA} = 9.9929\% = 9.9\%$$

Project B:-

$$NPV_i \Rightarrow -200 + 14V + 14V^2 + 14V^3 + 14V^4 + 14V^5 + 14V^6 + 200V^6 = 0$$

$$\Rightarrow -200 + 14V + 14V^2 + 14V^3 + 14V^4 + 14V^5 + 214V^6 = 0$$

For  $i = 7\%$ ;  $RHS = 1.8958$

$i = 7.3\%$ ;  $RHS = -0.8591$

$$\therefore \frac{x - 7\%}{7.3\% - 7\%} = \frac{0 - 1.8958}{-0.8591 + 1.8958}$$

$$\therefore x = 7.3\%$$

$$\therefore x = 6.4513\%$$

$$\therefore \underline{x = 6.5\%}$$

$$\therefore \underline{\underline{IRR_B = 6.5\%}}$$

b) NPV<sub>6%</sub>: For A  $\Rightarrow -170 + 10V^2 + 200V^3$   
 $= -170 + 10(1+6\%)^2 + 200(1+6\%)^3$   
 $= 6.8238K$   
 $= \underline{\underline{₹6823.8}}$

For B  $\Rightarrow -200 + 14V + 14V^2 + 14V^3 +$   
 $14V^4 + 14V^5 + 214V^6$   
 $= 11.4671K$   
 $= \underline{\underline{₹11467.10}}$

c) So, project A is more profitable!  
 $\Rightarrow$  Other factors:

- Lower IRR for 'B' applies for a longer period.
- Project A doesn't provide any net income during first years.
- Rates available in years 3 to 6 will affect the comparison b/w the accumulated profits at the E.O.Y 6.

Q3) Annuity 1: 200      200      200      200  
 1/2/1986   1/2/1987   1/2/1988 ..... 1/2/2007

Annuity 2: 320      320      320      320      320      320  
 1/1/1986   1/1/1986   1/1/1986   1/1/1986   1/1/1987 ..... 1/1/2002

Annuity 3: 180      180      180      180  
 1/12/1986   1/1/1986   1/2/1986 ..... 1/8/104

New Annuity :-

1/2/1986   1/8/1986   1/2/1987   1/8/1987      1/2/2007

→ PV of annuity 1  
 $\Rightarrow V^{3/12} \cdot 200 \ddot{a}_{27}$   
 $= \underline{\underline{2161.3655}}$

PV of annuity 2  
 $\Rightarrow 320 \ddot{a}_{16.25}^{(4)} \times V^{1/6}$   
 $= \underline{\underline{2996.0488}}$

PV of annuity 3  
 $\Rightarrow 15 \ddot{a}_{22.8} @ d^{(2)}/12$   
 $= \underline{\underline{1795.6514}}$

$$\therefore \text{Total amount} = \underline{\underline{6953.0658}}$$

$\therefore$  Revised

Annuity  $\Rightarrow$

$$6953.0658 = X \cdot \ddot{a}_{\overline{25}|}^{(2)} @ i=0.08$$

$$\therefore X = \underline{\underline{649.01356}}$$

Q4)  $(I\ddot{a})_{\overline{n}|}$  for  $i > 0$  T.P  $I\ddot{a}_{\overline{n}|} = \frac{\ddot{a}_{\overline{n}|} - nv^n}{d}$   
 Derive this from first principles.

→ First principle:-  $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} = f'(x)$

① → ∴  $PV = 1 + 2v + 3v^2 + \dots + nv^{n-1}$

Multiplying  $(1-d)$  on both sides

② → ∴  $(1-d)PV = 1 + 2v^2 + \dots + (n-1)v^{n-1} + nv^n$

∴ ① - ②

$d(PV) = (1 + v + v^2 + \dots + v^{n-1}) - nv^n$

we know that  $1 + v + v^2 + \dots = \ddot{a}_{\overline{n}|}$

∴  $PV = \frac{\ddot{a}_{\overline{n}|} - nv^n}{d}$  ∴ proved!

Q5) Time weighted ROR for 2014:-  
 (i)

$$(1+i) = \frac{13.1}{12.4} \times \frac{14.8}{13.1} \times \frac{15.8}{14.8} \times \frac{16.4}{15.8}$$

$$= \frac{16.4}{12.4}$$

∴  $i = 32.258\%$

TwRR for Equity fund:-

$$(1+i) = \frac{9.2}{12.1} \times \frac{10.3}{9.2} \times \frac{13.1}{10.3} \times \frac{15.8}{13.1}$$

∴  $i = 28.0991\%$

$$(ii)(a) \quad 12.4(1+i)^{\frac{1}{4}} + 13.1(1+i)^{\frac{3}{4}} + 14.8(1+i)^{\frac{1}{2}} + 15.8(1+i)^{\frac{1}{4}} = 4 \times 16.4$$

where  $i = 29.32\%$

Project → Equity fund

$$12.1(1+i) + 9.2(1+i)^{\frac{3}{4}} + 10.3(1+i)^{\frac{1}{2}} + 13.1(1+i)^{\frac{1}{4}} = 4 \times 15.8$$

$\therefore i = 67.31\%$

Q6)  $C = 160000$  ; in arrears for 10 yrs  
payable annually  
 $i = 8\% \text{ p.a}$

$$\begin{aligned} \text{i) Annual Repayment} &= \frac{160000}{a_{\overline{10}|8\%}} \\ &= \underline{\underline{\text{₹ } 23844.65209}} \end{aligned}$$

$$\begin{aligned} \text{ii) } \text{Loan o/s @ E.O } 4^{\text{th}} \text{ year} &= \text{Loan o/s at } t=4 \\ &= 23844.6520 \times a_{\overline{4}|8\%} \\ &= \text{₹ } 110231.4422 \end{aligned}$$

$$\begin{aligned} \therefore \text{Revised annual} \\ \text{repayment} &= \frac{110231.4422}{a_{\overline{6}|10\%}} \\ &= \underline{\underline{\text{₹ } 25309.72428}} \end{aligned}$$

$$\begin{aligned} \text{iii) Loan o/s @ E.O } 7^{\text{th}} \text{ year} \\ &= 25309.72428 \times a_{\overline{3}|10\%} \\ &= \text{₹ } 62942.75331 \end{aligned}$$

$$\begin{aligned} \therefore \text{Revised annual} \\ \text{repayment} &= \frac{62942.75331}{a_{\overline{3}|9\%}} \\ &= \underline{\underline{\text{₹ } 24865.7817}} \end{aligned}$$

$$\begin{aligned} \text{we had } 160000 &= X \cdot a_{\overline{4}|8\%} + \\ &\quad X \cdot a_{\overline{3}|10\%} \times v^4 @ 8\% \\ &\quad + X \cdot a_{\overline{2}|9\%} \times v^7 @ 8\% \\ &= X(3.3121) + X(2.4869) \times \\ &\quad 0.68058 \end{aligned}$$

$$+ X(2.5313) \times 0.54027$$

$$= 3.3121X + 1.6925X + 1.3675X$$

$$= 6.3721X$$

$$\therefore X = \frac{160000}{6.3721} = ₹ 25109.12484$$

$\therefore$  Effective R.O.I for 10 yrs  $\Rightarrow$

$$160000 = 25109.1248 \times A_{10} @ i\%$$

$$= 25109.1248 \times \left( \frac{1 - (1+i)^{-10}}{i} \right)$$

$$\therefore 6.3721 = \frac{1 - (1+i)^{-10}}{i}$$

$$\text{For } i = 9\% ; \text{ RHS} = 1.00714$$

$$i = x\% ; \text{ RHS} = 1$$

$$i = 9.2\% ; \text{ RHS} = 0.9983$$

$$\therefore \frac{x - 9\%}{9.2\% - 9\%} = \frac{1 - 1.00714}{0.9983 - 1.00714}$$

$$9.2\% - 9\% \quad 0.9983 - 1.00714$$

$$\therefore x = 0.091615$$

$$x = 9.161\%$$

$$\underline{\underline{\quad \quad \quad}}$$

Q7)

- i) (1) Properties are not as liquid as stocks or other government securities
- (2) They are very costly as compared to government securities.
- (3) Maintenance is required.
- (4) Might become a liability later.
- (5) Interest rates may hike in property investments, thus again a shock to your pockets.
- (6) If tenants exist, might create even more problematic scenarios which isn't in the case of government securities.

- ii) a) A tender loan is provided by the bank exclusively to participants of public trading, the lender provides documents showing the profitability of the enterprise.

Q8)

(i) P.V of outlay  $\Rightarrow 2.7 + 0.2 a_{\overline{3}|i\%}$

Expected P.V of income  $\Rightarrow$

$$0.1v^3 + \overline{a}_{\overline{10}|i\%} (0.25v + 0.2v^2 + 0.1v^3) @ i\%$$

Equating both, we have

$$2.7 + 0.2 a_{\overline{3}|i\%} = 0.1v^3 + \overline{a}_{\overline{10}|i\%} (0.25v + 0.2v^2 + 0.1v^3)$$

$$\underline{\underline{\therefore i = 9.3\%}}$$

(ii) Based on this,

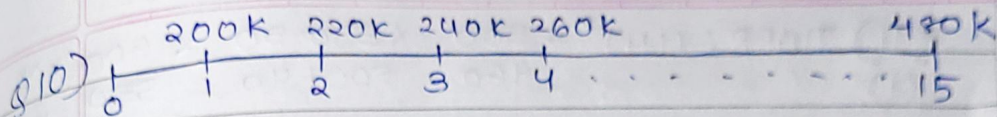
$$0.1v^3 + 0.85 \overline{a}_{\overline{10}|i\%} v^3$$

$$0.1v^3 + 0.85 \overline{a}_{\overline{10}|i\%} v^3 - 2.7 - 0.2 a_{\overline{3}|i\%} @ i = 10\%$$

$$\therefore NPV = 1.0089\%$$

Since NPV is +ve, hence its worth is to invest in project 1.

iii) TWRR eliminates the effect of cash flow amount of timing and hence gives a basis assessing the investment performance for the fund. ~~MIRR~~ <sup>MIRR</sup> is sensitive amount of timing the net cashflows.



$i = 12\% \text{ p.a.}$

$$\begin{aligned}
 \text{i) Loan amount} &= 180 \bar{a}_{\overline{15}|i} + 20 (I\bar{a})_{\overline{15}|i} \\
 &= 180 \times 9.69 \times i + 20 \left[ \frac{\bar{a}_{\overline{15}|i} - 15v^{15}}{i} \right] \\
 &= 1298.1270 + 20 [43.1288] \\
 &= 2160.704K \\
 &= \underline{\underline{\text{₹} 2160704.789}}
 \end{aligned}$$

∴ Total Cost of

house = ₹ 2700880.986

ii) Loan o/s at beginning of 9<sup>th</sup> year

$$\begin{aligned}
 \therefore L &= (180000v + 180000v^2 + \dots + 180000v^8) \\
 &\quad + (9 \times 20000v + \dots + 20000v^8)
 \end{aligned}$$

∴  $L(9) = \underline{\underline{1875850.33}}$

Loan schedule:

| year | Loan o/s   | Int. Int         | Cap Rep |
|------|------------|------------------|---------|
| 9    | 1875850.33 | 360060.255<br>04 | 134k    |
| 10   | 1740952.37 | 380000.208<br>28 | 111k    |
| 11   | 1569866.65 |                  |         |

Q11) TWRR:  $(1+i)^2 = \frac{500 \times 550 - 50 \times 600}{460 \times 500 + 40 \times 550} \times \frac{600}{550}$   
 (i)

$$\therefore 0.2 = \frac{500 \times 550 \times X}{460 \times 500 \times 550}$$

$$\therefore X = \underline{\underline{786.9312}}$$

(ii) MWRR:  $460(1+i)^2 + 40(1+i)^{2/12} - 50(1+i)^2$   
 $= 786.93$

$$\therefore i = \underline{\underline{30.9\%}}$$

Q12)

(i) DPP is the no. of yrs after which the cumulative discounted cash flows covers the initial investment.

$$(ii) (a) \text{ DPP} \Rightarrow -800(1+i)^t - 50(1+i)^{t-1} + 100 \text{ @ } 7\%$$

$$\therefore t = 17.767 \text{ by interpolation.}$$

$$(b) \text{ Accumulated profit after 22 yrs} \Rightarrow 100 \times 4.2337 \text{ @ } 6\% = 480$$

$$\therefore \text{A. Profit} = \underline{\underline{\text{₹} 480,000}}$$

(iii) Business man may accumulate his rental income @ 6% each yr

$$\Rightarrow -800(1+i)^t - 50(1+i)^{t-1} + 102.978 \text{ @ } 7\%$$

$$\therefore \underline{\underline{t = 18 \text{ yrs}}}$$

Now,

$$-800(1+i)^{18} - 50(1+i)^{17} + 102.978 \text{ @ } 7\% \Rightarrow 9.7714$$

Accumulated profit after 2 yrs  $\Rightarrow$  (iii)  
 $9.7714(1+i)^4 + 105q @ 6\%$   
 $= \underline{\underline{₹462.79}}$

Q13)

(i)  $980K = X \cdot 12 \cdot a_{\overline{25}|}^{12}$

$\therefore \underline{X = 76848}$

(ii) Loan o/s immediately after 10<sup>th</sup> March 2029,

$\Rightarrow X \cdot a_{\overline{20/3}|}^{12} = 648600 @ 7\%$

(iii) Loan o/s just after repayment on 10<sup>th</sup> Sep 2029

$\Rightarrow X \cdot a_{\overline{17/6}|}^{(12)} @ 7\%$

Loan o/s after 10<sup>th</sup> Oct 2026

$\Rightarrow X \cdot a_{\overline{13/4}|}^{(12)} @ 7\%$

Capital repaid on 10<sup>th</sup> Oct 2026

$X \left[ a_{\overline{83/12}|} - a_{\overline{5.75}|}^{(12)} \right] @ 7\%$

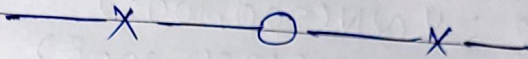
$\Rightarrow \underline{26.86}$

(iv)

(i) Cap. Rep. continued in 2 installments,

$X \left[ a_{\overline{22/3}|}^{(12)} - a_{\overline{19/3}|}^{(12)} \right] @ 7\%$

(ii) Total interest in 12 installments,  
 $\Rightarrow \underline{\underline{305.56}}$



$$L_0(1 + r)^n + \frac{C}{r} \left[ (1 + r)^n - 1 \right] = 0$$

$$0.10(1.000)^n$$

$$(0.000 - 0.000 \times 1.000)$$

$$0.000000$$

$$[0.000000 \times 1.000]$$

$$0.000000$$

$$0.000000$$

$$(1.000)^n$$

$$0.10(1.000)^n + \frac{C}{r} \left[ (1.000)^n - 1 \right] = 0$$

$$0.10(1.000)^n + \frac{C}{r} \left[ (1.000)^n - 1 \right] = 0$$

$$0.10 + 0.000 = 0$$

$$0.10 + 0.000 = 0$$

$$0.10 + 0.000 = 0$$

$$0.10 + 0.000 = 0$$

$$[0.10 + 0.000] \times 1.000 = 0.10 + 0.000$$

$$0.10 + 0.000 = 0.10 + 0.000$$

$$0.10$$

$$[0.10 + 0.000] \times 1.000 = 0.10 + 0.000$$

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