FM Assignment 2

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Q1) Loan amt = 20000

427.9 427.9 ... 427.9

0 1/12 2/12 . . . . . . 60/12

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

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

we have $i = 8.947\%$

$\therefore S_{\overline{5}|} = \dfrac{(1+i)^n - 1}{i} = 427.9 \times 12 \times 5.9783$

$= 30697.8568$

$\therefore APR = \dfrac{2 \times 10697.8568}{20000}$

$= 0.108 = 10.8\%$

(ii) $PV_1 = 427.9 \times 12 \; a^{(12)}_{\overline{4}|} \; @ \; i = 10.8\%$

$\therefore PV_1 = 16775.97728$

$\therefore PV_1 = 12(274.49) \; a^{(12)}_{\overline{T}|} \; @ 10.8\%$

$\therefore T = 7.25$ yrs

(iii) Interest paid in 1st loan = 3763.22

Int paid in 2nd = 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 cashflows and recognizing time value of money.

b) Payback Period :-
It is found by counting the no. of years it takes before the cumulate 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 cashflows, thus is more accurate than PP.

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iii) Project A:-

$$\begin{array}{ccccc} -170K & \cancel{+20K}\ -20K & +20K\ -10K & +200K & \\ 0 & 1 & 2 & 3 & \end{array}$$

Project B:-

$$\begin{array}{ccccccc} -200K & +14K & +14K & +14K & +14K & +14K & +14K + 200K \\ 0 & 1 & 2 & 3 & 4 & 5 & 6 \end{array}$$

a) IRR Project A:-

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

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

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

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

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

$i = x\%$; $y = 0$

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

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

$\therefore x = 9.9929\%$

$\therefore IRR_A = 9.9929\% = 9.9\%$

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 $= 1.8958$

$i = x\%$; $y = 0$

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

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

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$\therefore x = 6.4513\%$

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

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

b) NPV 6%. For A $\Rightarrow -170 + 10v^2 + 200v^3$

$= -170 + 10(1+6\%)^{-2} + 200(1+6\%)^{-3}$

$= 6.8238K$

$= ₹6823.8$

For B $\Rightarrow -200 + 14v + 14v^2 + 14v^3 +$

$14v^4 + 14v^5 + 214v^6$

$= 11.4671K$

$= ₹11467.10$

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 year.
- Rates available in years 4 to 6 will affect the comparison b/w the accumulated profits at the E.O.Y 6.

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Q3) Annuity 1:

200 — 1/2/1986, 200 — 1/2/1987, 200 — 1/2/1988 ..... 200 — 1/2/2007

Annuity 2:

320 — 1/1/1986, 320 — 1/4/1986, 320 — 1/7/1986, 320 — 1/10/1986, 320 — 1/1/1987 ..... 320 — 1/1/2002

Annuity 3:

180 — 1/12/1985, 180 — 1/1/1986, 180 — 1/2/1986 ..... 180 — 1/8/04

New Annuity :-

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

→ PV of annuity 1

$\Rightarrow v^{3/12} \cdot 200\, \ddot{a}_{\overline{21}|}$

$= \underline{2161.3655}$

PV of annuity 2

$\Rightarrow 320\, a^{(4)}_{\overline{16.25}|} \times v^{1/6}$

$= \underline{2996.0488}$

PV of annuity 3

$\Rightarrow 15\, \ddot{a}_{\overline{226}|}$ @ $d^{(12)}/12$

$= \underline{1795.6514}$

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

$\therefore$ Revised
Annuity $\Rightarrow$

$$6953.0658 = X.\ \ddot{a}^{(2)}_{\overline{24.5}|} \ @\ i=0.08$$

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

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:- $\lim_{h \to 0} \frac{f(x+h)-f(x)}{h} = f(x)$

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

Multiplying $(1-d)$ on both sides

② → ∴ $(1-d)\, P.V = \cancel{v}\ i + 2v^2 + \dots (n-1)v^{n-1} + nv^n$

∴ ① − ②

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

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:-

$(1+i) = \frac{9.2}{12.1} \times \frac{10.3}{9.2} \times \frac{13.1}{10.3} \times \frac{15.\cancel{8}}{13.1}$

∴ $i = 28.0991\%$

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

where $i = 29.32\%$

Project → Equity fund

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

$\therefore i = 67.31\%$

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Q6) $C = 160000$; in arrears for 10 yrs payable annually

$i = 8\%$ p.a

i) Annual Repayment $= \dfrac{160000}{a_{\overline{10}|} @ 8\%}$

$= ₹\ 23844.65209$

ii) Loan o/s @ E.O ~~cap. Rep in first~~ 4^{th} year = Loan o/s at t=4

$= 23844.6520 \times a_{\overline{6}|} @ 8\%$

$= ₹110231.4422$

∴ Revised annual repayment $= \dfrac{110231.4422}{a_{\overline{6}|} @ 10\%}$

$= ₹\ 25309.72428$

iii) Loan o/s @ E.O 7^{th} year

$= 25309.72428 \times a_{\overline{3}|} @ 10\%$

$= ₹\ 62942.75331$

∴ Revised annual repayment $= \dfrac{62942.75331}{a_{\overline{3}|} @ 9\%}$

$= ₹\ 24865.7817$

we had $160000 = X . a_{\overline{4}|} @ 8\% +$

$X . a_{\overline{3}|} @ 10\% . \times v^5 @ 8\%$

$+ X . a_{\overline{3}|} @ 9\% \times v^8 @ 8\%$

$= X(3.3121) + X(2.4869) \times$

0.68058

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

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

$$= 6.3721X$$

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

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

$$160000 = 25109.1248 \times a_{\overline{10}|} @ i\%$$

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

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

For $i = 9\%$; RHS $= 1.00714$

$i = x\%$ RHS $= 1$

$i = 9.2\%$; RHS $= 0.9983$

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

$$\therefore x = 0.091615$$

$$x = 9.161\%$$

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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 exists, 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.

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Q8)

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

Expected P.V of income $\Rightarrow$

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

Equating both, we have

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

$\therefore i = 9.3\%$

(ii) Based on this,

$0.1v^3 + 0.85\bar{a}_{\overline{10|}}\, v^3$

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

$\therefore$ NPV = 1.0089 %.

Since NPV is +ve, hence it's worth is to invest in project 1.

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+6 +4.5 -2.5

Q9) 1/1/11, 30/9/11, 31/12/2011, 1/7/2012, 31/12/2013, 30/6/2012, 31/12/2013

30.5, 33, 38.5, 41.05, 45, 45.6, 47

i) TWRR

$$\Rightarrow (1+i)^3 = \frac{33}{30.5} \times \frac{38.5}{33+6} \times \frac{41.05}{38.5+4.5} \times \frac{45}{41.05} \times \frac{45.6}{45} \times \frac{47}{45.6-2.5}$$

$\therefore (1+i)^3 = 1.2351$

$\therefore 1+i = 1.07294$

$\therefore i = 7.294\%$

ii) LROR:- 2011 $\Rightarrow 30.5(1+i)+6(1+i)^{0.25} = 38.5$

$\therefore i = 6.266\%$

2012 $\Rightarrow 38.5(1+i)+4.5(1+i)^{0.5} = 45$

$\therefore i = 4.92\%$

2013 $\Rightarrow 45(1+i)+2.5(1+i)^{0.5} = 47$

$i = 10.27\%$

$\therefore$ LROR $\Rightarrow (1+i)^3 = (1+0.6266) \times (1+0.0492) + (1+0.1027)$

$\therefore i = 7.13\%$

iii) TWRR eliminates the effect of cashflow amount of timing and hence gives a basis assessing the investment performance for the fund. MWRR is sensitive amount & timing the net cashflows.

Q10)

0	1	2	3	4	. . .	15
	200K	220K	240K	260K		470K

$i = 12\%$ p.a

i) Loan amount $= 180\, a_{\overline{15}|}^{@12\%} + 20\,(I\bar{a})_{\overline{15}|}^{@12\%}$

$= 180 \times a_{\overline{15}|} \times \frac{i}{\delta} + 20\left[\frac{\ddot{a}_{\overline{15}|} - 15v^{15}}{\delta}\right]$

$= 1298.1270 + 20\,[43.1288]$

$= 2160.704K$

$=$ ₹2160704.789

$\therefore$ Total cost of house $=$ ₹2700880.986

ii) Loan o/s at beginning of 9^{th} year

$\therefore L = (180000v + 180000v^2 + \ldots 180000 a_{\overline{7}|})$
$+ (9 \times 20000\, v \ldots \cancel{\ }\times 20000 a_{\overline{7}|})$

$\therefore L(9) = 1875850.33$

Loan schedule:

year	Loan o/s	Int.	Int	Cap Rep
9	1875850.33	360000	255102.04	134k
10	1740952.37	380000	208914.28	111k
11	1569866.65			

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Q 11) (i) TWRR: $(1+i)^2 = \frac{500}{460} \times \frac{550-50}{500+40} \times \frac{600}{550} \times \frac{X}{600}$

$\therefore 0.2 = \frac{500 \times 500 \times X}{460 \times 540 \times 550}$

$\therefore X = 786.9312$

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

$\therefore i = 30.9\%$

Q12)

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

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

$\therefore t = 17.767$ by interpolation.

ⓑ Accumulated profit after 22 yrs $\Rightarrow$

$100\, s_{\overline{4.2337|}}$ @ 6% $= 480$

$\therefore$ A. Profit $=$ ₹480,000

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

$\Rightarrow -800(1+i)^t - 50(1+i)^{t-1} + 102.97\, s_{\overline{t|}}$ @ 7%

$\therefore t = 18$ yrs

Now,

$-800(1+i)^{18} - 50(1+i)^{17} + 102.97\, s_{\overline{6|}}$ @ 7%

$\Rightarrow 9.7714$

Accumulated profit after 24 yrs $\Rightarrow$

$$9.7714(1+i)^4 + 10\,s_{\overline{4}|} \text{ @ } 6\%$$

$$= ₹\, 462.79$$

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Q13)

(i) $980K = X 12 \, a^{(12)}_{\overline{25}|}$

$\therefore X = 76848$

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

$\Rightarrow X \cdot a^{(12)}_{\overline{3.5}|} = 648600$ @ 7%.

(iii) Loan o/s just after repayment on 10th Sep 2026

$\Rightarrow X \cdot a^{(12)}_{\overline{5.75/6}|}$ @ 7%.

Loan o/s after 10th Oct 2026

$\Rightarrow X \, a^{(12)}_{\overline{13/3}|}$ @ 7%.

Capital repaid on 10th Oct 2026

$X \left[a^{(12)}_{\overline{83/6}|} - a^{(12)}_{\overline{5.75}|} \right]$ @ 7%.

$\Rightarrow 26.86$

(iv)

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

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

(ii) Total interest in 12 installments,

$\Rightarrow$ 305.56

—x—o—x—