Kshiti Vartak Roll.NO: 86 Section B

FM Assignment 2

Q1]

i]

$APR = I = 20000 = 12 \times 427.90 \; a_5^{(12)} = 3.89499$

APR is usally double the flat rate of interest.

$\text{Flat rate} = \dfrac{\text{total interest}}{\text{loan} \times \text{total years}} = \dfrac{5 \times 12 \times 427.90 - 20000}{20000 \times 5}$

$= 5.67\%$

$\therefore$ ~~AR~~ APR $\approx 11\%$

At $i = 11\%$, $a_5^{(12)} = 3.87872$

At $i = 10\%$, $a_5^{(12)} = 3.96154$

APR, I is

$\dfrac{i - 10\%}{3.89499 - 3.96154} = \dfrac{11\% - 10\%}{3.87872 - 3.96154}$

$i = 10.8\%$

At $i = 10.8\%$, $12 \times 427.90 \; a_5^{(12)} = 20.000.2$

At $i = 10.9\%$, $12 \times 427.90 \; a_5^{(12)} = 19.968.3$

$i = 10.8\%$ is more close. Hence, APR is 10.8%

ii] APR $= 10.8\%$

After 1 year, capital left to pay ~~= 12 × 427.90~~

$= 12 \times 427.90 \; a_4^{(12)}$ @ 10.8%

$= \cancel{1677}\ 16775.98$

Let t be the term of new loan.

$$16775.98 = 12 \times 274.49\, a_{t}^{(12)}$$

$$16775.98 = 3293.88 \times \frac{1 - 1.108^{-t}}{12 \times (1.108^{1/12} - 1)}$$

$$1.108^{-t} = 0.4754$$

$$t = 7.25 \text{ years}$$

iii) The original loan had 4 years of paymen[t]
remaining, thus

Total interest $= 4 \times 12 \times 427.90 - 16775.98 = 3763.$

New loan has term $= 7.25$ years.

Total Interest $= 7.25 \times 12 \times 274.49 - 16775.98$
$= 7104.65$

Thus, Mr. & Mrs. Jones will pay 3341.43 more interest under the restructured loan.

2]

i]

a. The discounted payback period is the smallest time t for which the present (or accumulated) value of the returns up to time t exceeds the present (or accumulated) value of the costs up to time t.

b. The payback period is the same as the discounted payback period except that the present value calculation (or accumulation) is carried out using an interest rate of 0. In other words, it is the earliest time for which the monetary value of the returns exceeds the monetary value of costs.

ii] Unlike the NPV, neither the DPP nor the PP give any indication of how profitable a project is, as they ignore cash flows after the accumulated value of zero is reached.

There may not be one unique time when the balance in the investor's account changes from negative to positive. However, the NPV can always be calculated.

The PP can give misleading results, as it does not take into account the time value of money.

Hence NPV is a superior measure as compared to DPP or PP.

iii]

a) Internal rate of return

The IRR for project A is the rate of interest that satisfies the equation of value:

$-170000 - 20000v - 10000v^2 + 20000v + 20000v^2 + 200000v^3 = 0$

$10v^2 + 200v^3 = 170$

Consider,

$i = 7\%$; $10v^2 + 200v^3 = 171.99$

$i = 8\%$; $10v^2 + 200v^3 = 167.34$

Using interpolation:

$$i = 7 + \frac{170 - 171.99}{167.34 - 171.99} * (8-7) = 7.4\%$$

For Project B, the income represent 7% of the initial capital, which is returned at the end of 6 years.

IRR for Project B = 7%

Alternatively:

$14 a_6 + 200v^6 = 200$

b) Net Present value

The net present values are found by discounting the payments at 6%.

Project A: NPV $= -170000 + 10000v^2 + 200\,000v^3 =$ INR 6823.82

Project B: NPV $= -200000 + 14000\, a_{6} + 200000v^6 =$ INR 9834.65

c) Maximum Interest Rate beyond which the projects are unprofitable.

Each project will be profitable if the rate of interest at which funds can be borrowed is less than the internal rate of return. So to be profitable, Project A requires a borrowing rate less than 7.4% and Project B requires a rate lower than 7%

3]

Value at 1st November 1985 is

$$\text{Annuity } 1 = 200 \times v^{\left(\frac{1}{4}\right)} \times \ddot{a}_{\overline{22}|} \text{ at } 8\%$$
$$= 200 \times 0.98094 \times 11.0107 = 2161.36$$

$$\text{Annuity } 2 = 320 \times (1+i)^{\left(\frac{1}{12}\right)} \times a^{(4)}_{\overline{16.25}|} \text{ at } 8\%$$
$$= 320 \times 1.00643 \times 9.18425 = 2957.87$$

$$\text{Annuity } 3 = 180 \times a^{(12)}_{\overline{18.75}|} = 180 \times 9.892583$$
$$= 1780.66$$

Total value of all three annuities = 6899.90

Let the revised annuity be A

Value of the revised annuity is $= A \times (1+i)^{1/4} \times a$

$$A = \frac{6899.90}{1.019427 \times 10.30886} = 656.56$$

i] The time ~~weigh~~ weighted rate of return for Property Fund

$\frac{16.4}{12.4} - 1 = 0.3226$ or 32.26%

The time weighted rate of return for Equity Fund

$\frac{15.5}{12.1} - 1 = 0.2810$ or 28.10%

ii] a) Assuming that the investor brought 100 units per quater in property fund the equation of value is given by

$$1240(1+i) + 1310(1+i)^{3/4} + 1480(1+i)^{1/2} + 1580(1+i)^{1/4}$$

$$= 4 \times 1640$$

where i is the yield per annum $= 0.29820$
$= 29.82\%$

b) Assuming that the investor purchases INR 100 worth of units each quarter

$$400 \times \ddot{s}^{(4)}_{\overline{1|}} = 100 \times \cancel{16} \; 16.4 \left(\frac{1}{12.4} + \frac{1}{13.1} + \frac{1}{14.8} + \frac{1}{15.8} \right)$$

$\ddot{s}^{(4)}_{\overline{1|}} = 1.1801$ that gives $i = 0.2979$ or 29.8%

iii] a) Assuming that the investor bought 100 units per quater in Equity fund the equation of value is given by

$$1210(1+i) + 920(1+i)^{3/4} + 1030(1+i)^{1/2} + 1310(1+i)^{1/4}$$
$$= 4 \times 1550$$

where i is yield per annum $= 67.31\%$

b) Assume that the investor purchase INR 100 worth of units each quater.

$$400 \times \ddot{s}_{\overline{1}|}^{(4)} = 100 \times 15.5\left(\frac{1}{12.1} + \frac{1}{9.2} + \frac{1}{10.3} + \frac{1}{13.1}\right)$$

$\ddot{s}_{\overline{1}|}^{(4)} = 1.4135$ & this gives $i = 0.7088$ or 70.88%

c] i] Let X be the initial annual repayment

$160,000 = X a_{\overline{10}|}$ at 8%

$$X = \frac{160000}{a_{10}} = \frac{160000}{6.7101} = 23844.65$$

ii] The loan outstanding immediatly after the fourth payment is made is:

$23844.65\ a_{\overline{6}|}$ at $8\% = 23844.65 \times 4.6229$

$= 110231.44$

Let Y be the revised annual installment.

The equation of value is $Y\ a_6 = 110231.44$ at 10%

$$Y = \frac{110231.44}{a_{\overline{6}|}} = \frac{110231.44}{4.355} = 25309.72$$

iii] The loan outstanding immediately after the seventh payment is made is

$25309.72\ a_{\overline{3}|}$ at 10%

$= 25309.72 \times 2.4869 = \cancel{6229}\ 62942.74$

Let z be the revised annual installment

$Z\ a_3 = 62942.74$ at 9%

$$Z = \frac{62942.742}{a_{\overline{3}|}} = \frac{62942.742}{2.5313} = 24865.77$$

Yield =

$$160000 + 1465.07 \times a_{\overline{7}|} - 443.95 \times a_{\overline{7}|} - 24865.77 v^{9}_{\overline{10}|} = 0$$

By interpolation between 8% and 9%, the yield or effective rate of interest per annum is 8.4%

8% = -4310.73

9% = 2930.93

7 a) Government may raise money by floating a loan on stock exchange. The terms of the issue are set out by tender. The investors are invited to nominate the price that they are prepared to pay and the loan is issued to the highest bidders, subject to certain rules of allocation.

b) Advantages

The government will know the price that the investor will pay at outset so it will know the cost of borrowing money

It will be administratively less difficult by tender.

•

Disadvantages

The investor may be willing to pay more for the bond than the set price and so the money could be borrowed more cheaply ~~to~~, insufficient if ~~the~~ tender is used investor may be prepared to pay the set price causing only part of the offer to be old and the Government may not meet it finance requirement.

c) Securities with uncertain income include:
1) Equities 2) Property 3) Index ~~I~~ Linked bonds

8]

i] The present value of outlay is:

$2.7 + 0.2a_{\overline{3}|}$ @ i

The expected present value of the income is:

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

Equating the present value of the outlay to the present value of the income and solving for i:

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

This gives $i = 9.3\%$

ii) Based on the information, the present value of the company's income is:

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

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

$0.1 \times 0.7513 + 0.85 \times 0.7513 \times 6.4469 - 2.70 - 0.2 \times 2.4868$

$= 4.19 - 3.19$

$= 1.0089$

Since NPV is positive it is worth to invest in the project

i) TWRR

$\cancel{(1+i)^3 = 33/30.50 \times (41.05-4.5)/(33+6) \times}$

$$(1+i)^3 = \frac{33}{30.50} \times \frac{(41.05-4.5)}{(33+6} \times \frac{45.6}{41.05} \times \frac{47}{(45.6-2.5)}$$

$(1+i)^3 = 1.0818967 \times 0.937179 \times 1.11084 \times 1.09048$

$= 1.228313$

$(1+i) = 1.070951$

TWRR = 7.0951%

MWRR

$30.5 \times (1+i)^3 + 6 \times (1+i)^{2.25} + 4.5 \times (1+i)^{1.5} - 2.5(1+i)^{0.5}$

$= 47$

At $i = 7\%$, LHS = 46.74

At $i = 7.5\%$, LHS = 47.87

By interpolation,

MWRR = 7.206%

ii) Linked rate of return

Year 2011 - equation of value

$30.5 \times (1+i) + 6 \times (1+i)^{0.25} = 38.50$

$i = 6\%$, LHS = 38.42

$i = 6.5\%$, LHS = 38.57

By interpolation; $i = 6.266\%$

Year 2012 - equation of value

$38.50(1+i) + 4.50(1+i)^{0.50} = 45$

$i = 4.5\%$, LHS = 44.83

$i = 5\%$, LHS = 45.09

By interpolation, $i = 4.92\%$

Year 2019 - equation of value

$45(1+i) - 2.50(1+i)^{0.5} = 47$

$i = 10\%$, LHS $= 46.88$

$i = 10.5\%$, LHS $= 47.097$

By interpolation

$i = 10.276\%$

Linked rate of return,

$(1+i)^3 = (1+00.6266)(1+0.0492)(1+0.10276)$

$(1+i)^3 = \$1.2295$

$i = 7.13\%$

10] i] Let the loan amount be Rs L

$L = 180000 \times a_{\overline{15}|} + 20000 \times (Ia)_{\overline{15}|}$ @ 12%

$= 180000 \times 6.8109 + 20000 \times \frac{(\ddot{a}_{\overline{15}|} - 15v^{15})}{}$

$= 1225962 + 20000 \frac{(7.6282 - 2.74044)}{0.12}$

$= 1225902 + 20000 \times 40.7313 = 2040588$

L = RS20,40,588

Total cost of house $= \frac{2040588}{0.8}$ = RS 25,50,735

ii] The loan outstanding at the beginnig of the ninth year

$L = (180000v + 180000v^2 + \dots + 180000v^7) +$

$(9 \times 20000v + 10 \times 20000v^2 + \dots + 15 \times 20000v^7)$

$L(9) = 340000 \times a_{\overline{7}|} + 20000 \times (Ia)_{\overline{7}|}$ @ 12%

$= 340000 \times 4.5638 + 20000 \times \frac{(5.1114 - 7 \times 0.46235)}{0.12}$

$= 1551672 + 324158.33$

$=$ RS 1875850.33

Loan Schedule:

Year	Loan Outstanding	Loan installment	Interest
9	1875,8,50.33	3,60,000	2,25,102.04
10	17,40952.37	3,60,000	2.08914.28
11	15,69,866.65		

Capital Repayment
1,34,897.96
1,71,085.72

i) The discounted payback period of an ~~investigation~~ investment project is the first time when the net present value of the cash flows from the project is positive

ii) a) Let us work in units of 1000, to find DPP

$-800(1+i)^t - 50(1+i)^{t-1} + 100\ \bar{s}_{\overline{t-2}|}$ at 7% = 0

At t=17 the net present value is −75

At t=18 the net present value is 22.85

Hence by interpolation t = 17.767.

b) The accumulated profit after 22 years is found by accumulating the income at 6% p.a. after DPP has elapsed

$100\ \bar{s}_{\overline{4.233}|}$ at 6% = 480

The accumulated amount in INR 48000

The

Q13]

i) Let $X/12$ be the monthly repayment.

$X a^{(12)}_{\overline{25}|} = 9880$ at 7%

~~X/12~~ $X = 821.76$

$X/12 = 821.76/12 = 68.48$

Hence, the monthy repayment is INR 68.48

ii) The loan outstanding immediately after the repayment on 10^{th} march 2029

$X a^{(12)}_{\overline{34/3}|} = 648600$ at 7%

iii) The loan outstanding just after the repayment on 10^{th} Sept 2026 is made

$X a^{(12)}_{\overline{83/6}|}$ at 7%

The loan outstanding just after the repayment on 10^{th} Oct 2026 is made

$X a^{(12)}_{\overline{13.75}|}$ at 7%

The capital repaid on 10^{th} Oct 2026 is thus

$$X\left[a^{(12)}_{\overline{83/6}|} - a^{(12)}_{\overline{13.75}|}\right] \text{ at } 7\%$$

$$= X\left[\frac{v^{13.75} - v^{83/6}}{i^{(2)}}\right] \text{ at } 7\%$$

$= 26.86$

iv) i) The capital repayment continued in these 12 instalments is $X\left[a^{(12)}_{\overline{22/3}|} - a^{(12)}_{\overline{19/3}|}\right]$ at 7%

$= 516.20$

ii) The total interest in these 12 instalments is

$X - 516.20 = 305.56$