Assignment-2

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Subject : Financial Mathematics.

Sol^n 1) (i) APR = 2 × Flat Rate

original loan = 20,000

$20,000 = 12 \times 487.9 \, a_{\overline{5}|}^{(12)}$

$a_{\overline{5}|}^{(12)} = 3.8499$

$\text{Flat Rate} = \left[\frac{5 \times 12 \times 427.9 - 20,000}{20,000 \times 5}\right] = 5.67\%$

$APR = 2 \times 5.67 \approx 11\%$

$i = 11\% \quad a_{\overline{5}|}^{(12)} = 3.8787$

$i = 10\% \quad a_{\overline{5}|}^{(12)} = 3.96154$

By Interpolation: $\frac{i - 10\%}{3.8479 - 3.9011} = \frac{11\% - 10\%}{3.8787 - 3.96}$

$\boxed{i = 10.8\%}$

(ii) APR: 10.8%.

Capital each = $12 \times a_{\overline{4}|}^{(12)} \times 427.9 = 16775.98$

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

$16778.98 = 3293.88 \left[\frac{1 - 1.108^{-t}}{12[1108^{\frac{1}{12}} - 1]}\right]$

$1.108^{-t} = 0.4785$

$t = 7.25$ years

(iii) Remaing loan has time of 4 years.

Interest $= 9 \times 12 \times 427.9 - 16775.68$
$= 3763.22$

Total Int. $= 7.25 \times 12 \times 274.9 - 16775.68$
$= 7104.65$

They will have to pay 3341.23 more rupees.

Sol^{n}

(2)

(i) (a) The time at which the PV of return exceed PV of cost is called discount payback period.

(b) The time at which moment of take at least a less the monetary value of return is called payback period.

(ii) Unlike NPV, nor Payback Period or discount payback period can decide the profitability of the project, as they ignore cash flow & time value of Money. Hence NPV is best method to evaluate project.

(iii) Internal rate of return.

(a) The IRR of Project A is the rate of interest it satisfies

$$-17000 - 20{,}000v - 10{,}000v^2 + 200000v + 200000v^2 + 200000v^3 = 0$$

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

$$200v^3 + 10v^2 - 170 = 0$$

c

$0.94 \rightarrow 4.9538$

$0.9309 \rightarrow 0.0046$

$\therefore v = 0.9909$

$\boxed{i = 7.42292\%}$

The IRR for Project B is the rate of interest that satisfies equation

$$1497 + 200v^6 = 200.$$

$\boxed{i = 7\%}$

(b) $NPV_A^{@6\%} = -170000 - 20{,}000v - 10{,}000v^2 + 20{,}000v + 200000v^2 + 200000v^3$

$= -170{,}000 + 10{,}000v^2 + 2{,}00{,}000v^3 = \boxed{6823.82}$

$NPV_B^{@6\%} = -200{,}000 + 140006\overline{97} + 200000v^6 = \boxed{9834.85}$

(c) Maximum Interest rate taken the project became unprofitable when the rate of borrow is less than rate of return.

- Other factor should be-

(i) We have to check the accumulated value of the project
(ii) Check the NPV of the both the project
(iii) Examine Time weighted or money-weighted rate.

Sol (3)

Annuity 1: $200 v^{1/4} \ddot{a}_{\overline{22}|}$ @8%

$= 2161.366301$

Annuity 2: $320(1+i)^{1/12} a^{(4)}_{\overline{16.25}|}$ @ 8%

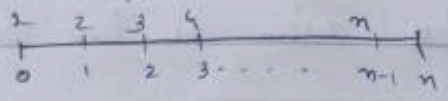
$= 2957.810081$

Annuity 3 = $180 \times a^{(12)}_{\overline{19.75}|}$

$= 1780.664166$

required annual = $\frac{6899.9}{1.0194 \times 10.30} = 656.56$

Sol^n (4) Value of $(I\ddot{a})_{\overline{n}|}$ $i>0$



$$(I\ddot{a})_{\overline{n}|} = 1 + 2v + 3v^2 + 4v^3 + \cdots + nv^{n-1} \quad \text{— (1)}$$

Multiply both side by v

$$v(I\ddot{a})_{\overline{n}|} = v + 2v^2 + 3v^3 + 4v^4 + \cdots + nv^n \quad \text{— (2)}$$

Subtract (2) from (1)

$$(1-v)(I\ddot{a})_{\overline{n}|} = 1 + v + v^2 + v^3 + \cdots + v^{n-1} - nv^n$$

$$d(I\ddot{a})_{\overline{n}|} = \frac{1-v^n}{d} - nv^n$$

$$\boxed{(CI\ddot{a})_{\overline{n}|} = \frac{\ddot{a}_{\overline{n}|} - nv^n}{d}}$$

Sol^n (5)

(1) Property

$$(1+i)^1 = \frac{16}{12.4}$$

$$\boxed{i = 32.26\%}$$

Equity

$$(1+i)^1 = \frac{15.5}{12.1}$$

$$\boxed{i = 28.10\%}$$

(ii)

(a) Since investor bought unit in quarter assume he bought 100 unit per quarter

$1240(1+i) + 1310(1+i)^{3/4} + 1480(1+i)^{1/2} + 1580(1+i)^{1/4} = 1640(4)$

$1240t + 1310t^{3/4} + 1480t^{1/2} + 1580t^{1/4} - 6560 = 0$

$1 = -95$

$1.2 = -29.81$

$1.3 = 2.145$

$1.28 = -0.012$

$1.293 = 0.0126$

$t \sim (1.293)$

$(1+i) \approx 1.293$

$\boxed{i = 29.3\%}$

(b) ~~$400\, s_{\overline{11}|}^{(4)} = 100 \times 15.5 \left(\frac{1}{12.1} + \frac{1}{9.2} + \frac{1}{10.3} + \frac{1}{13.1} \right)$~~

~~$16.5\, s_{\overline{11}|}^{(4)}$~~

~~$15.5 \times 4\, s_{\overline{11}|}^{(4)} = 100$~~

Sol^n

(a)

(i) $1,60,000 = X\, a_{\overline{10}|}^{@8\%}$

$1,60,000 = X\left[\frac{1-(1.08)^{-10}}{0.08}\right]$

12,800

$X = 23,844.72$

(ii) loan Outstanding at $t=4$: $23,844.72\, a_{\overline{6}|}^{@8\%}$

$= 110,231.26$

Revised Amud Pay

$110,231.26 = X\, a_{\overline{6}|}^{@10\%}$

$X = 25309.91$

(ii) loan Outsta at $t=7$: $25309.91 \times a_{\overline{3}|}^{@10\%}$

$= 62,942.$

Revised paymd

$62942 = X\, a_{\overline{3}|}^{@9\%}$

$X = 24,865.54$

Yeild = 1,60,000 +

Sol^n

(7)

(i) Investing in property may not be feasible alternative to investing in government securities.
It is difficult to invest in property while it is flexible to invest in the ~~pseudo~~ government.

(ii)

a) Government raise their fund generally by floating a loan or stock exchange, from here they also raise money to payout to the bond holders.

b) Advantages of the Bonds -

→ The amount is certain.

Disadvantage of the Bond.

→ If the inflation rat is high we will get the decided amount only.

c) Securities which have Uncertain Income

(i) Index-linked security : factor of inflation
(ii) Property : Rent may be ↑↓ depend on the condition of house
(iii) Equity : The share price can increase or decrease.

(8) $PV = 2.7 + 9\overline{3}|@i$

$E(PV) = 1.03v^3 + \bar{9}\overline{10}|(0.25v + 0.2v^2 + 0.1v^3)@i$

$2.7 + 0.29\overline{3}| = 0.1v^3 + \bar{9}\overline{10}|[0.25v + 0.2v^2 + 0.1v^3]$

$i = 4.54\%$

(ii) $0.1v^3 + 0.85\bar{9}\overline{10}|v^3 = 2.7 + 0.29\overline{3}|$ at

$0.1v^3 + 0.85\bar{9}\overline{10}|v^3 = 2.7 - 0.29\overline{3}|$ at i.

$= 1.0089.$

Hence the project is Profitable

(9) TWRR

(i) $(1+i)^3 = \frac{33}{30.5} \times \frac{41.05 - 4.6}{33+6} \times \frac{46.6}{41.05} \times \frac{47}{46.6 - 2.50}$

$(1+i)^3 = 1.228$

$i = 1.0709$

$i = 7.09\%$

MWRR

$30.5(1+i)^3 + 6(1+i)^{2.25} + 4.5(1+i)^{1.5} - 2.5(1+i)^{0.5} - 47$

$(1+i) = t$

$t \approx 1.07204$

$1+i = 1.07204$

$i = 7.204\%$

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

$1+i = 1.0625$

$\boxed{i = 6.25\%}$ (2011)

$BR.5(1+i) + 4.5(1+i)^{0.5} = 45$

$1+i = 1.0492$

$\boxed{i = 4.92\%}$ (2012)

$45(1+i) - 2.5(1+i)^{0.5} = 47$

$1+i = 1.1023$

$\boxed{i = 10.23\%}$ (2013)

(iii) TWRR is better than MWRR because it the time of cash flow in the account.

Solu (10) (i) loan am x.

$X = 1,8000\,a_{\overline{15}|} + 20,000\,(Ia)_{\overline{15}|}$ @ 12%.

$X = 180,000 \times 6.8109 + 20,000 \times 40.7314$

$\boxed{X = 2040588}$

Cost of house $= \frac{2040588}{0.8} = 2550735$

(ii) loan outstand at the beginning of 9th year $= 3,40,000\,a_{\overline{7}|}$ @12%

$- 3,40,000\,v^{7} + 20,000$

$- 1875,850.33$

Year	loan	Instalment	Interest	Capital repayment
9	1875850.33	3,60,000	225102.04	134897.96
10	17,40952.37	3,80,000	208914.28	171085.72

(iii) $1569866.65 = M a_{5|}$ @10%

$M = 414126.867$

Mr. Sam pay extra payment for the ,

(4000001 4,20,000... + 4,xxxx) − 1569866.65

= 6,30,133.35

Mr. Sam has to pay vh for the banstering is gr =

= 5×44126.9 + 0.01×1569866.65 − 1569866.65

= 9164.66.34.

Thus Mr. Sam should manage his Acc in Bank 2.

5(b)

(ii) i) IRR

$(1+i)^2 = \frac{800}{460} \times \frac{550+50}{500+40} \times \frac{x}{550}$

$(1+i)^2 = \frac{600x}{46\times540\times11}$

$(1+i)^2 = 1.44$

$\frac{1.44 \times 46\times540\times11}{600} = x$

$x = 655.78$

(ii) Money Weighted rate of return is given by equation follow

$460(1+i)^2 + 40(1+i)^{3/4} - 50(1+i) = 655.776$

$460t^2 + 40t^{3/4} - 50t = 655.776$

$(1+i) = +1.19981$

$\boxed{i = 19.85\%}$

(iii) The effective rate of return for year 2015 is given by

$460(1+i) + 40(1+i)^{3/4} = 600$

$460t + 40t^{3/4} = 600$

$t = 1.204$

$\boxed{i = 20.4\%}$

Effective rate of return the 2016 given by ?

$(1+i) = \frac{655.78}{550} = 1.92527$

$(1+i)^2 = 1.9251 \times 1.202137$

$1+i = 1.19884$

$\boxed{i = 19.884\%}$

(iv) When the sinking interval chosen for IIRR, coincide with interval btw net cash flow & cash being reciv, IIRR = MWRR

(v) The best to examine product.

(ii) MWRR is sensitive to the amount & timing of cash flows

(iii) TWRR is being used to been growth factor.

(iv) Hence TWRR is the best measure to evaluate project.

Sol^{n} (12) i) DPP of the investment Project is the first time when the net PV of the cash flow exceed the negative cash flow.

ii)

(a) Let take A unit = 1000

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

$$\boxed{t = 17.76 \text{ years}}$$

(b) Accumulated Profit at 22 year $= 100 \times \frac{(1.06)^{0.25} - 1}{\ln(1.06)} \times 1000$

$= \boxed{460074.306}$

(iii) Accumulation term into Consideration

$$100\bar{s}_{1|} = \frac{100 \times (1.06) - 1}{\ln(1.06)}$$

$$\boxed{= 102.97}$$

Smallest index as DPP

$$-800(1+i)^t - 50(1+i)^{t+1} + 102.97\, s_{t-1|} > 0$$

$$\boxed{t = 18 \text{ years}}$$

Balance left:

$-800(1+i)^{18} - 50(1+i)^{17} + 102.9715\overline{s}_{10}|$ @ 7%

$= 9.78$

AV after 28 year will be = $9.78(1+i)^4 + 100\overline{s}_{4}|$ @ 6%

$= 462.801 \times 1000$

$= 462801.8$

Sol^n

(13) (i) $9880 = X\, a^{(12)}_{\overline{25}|}$

$X = 821.7669096$.

Monthly ... r/12

Monthly = 68.48 x 100. Rs

Monthly repayment = 6848.05

(ii) loan after the repayment of 10th March = $X\, a^{(12)}_{\overline{34}|}$

$- 6485.05 \times a^{(12)}_{\overline{24}|}$

$= 6485.7468 \times 100$

$= 648674.93$

(iii) The loan o/s after payment on 10th Septn 2020 is $X\, a^{(12)}_{83/6}$ @ 7%.
The loan o/s after repayment on 10th October 2020 is $X\, a^{(12)}_{55/4}$ @ 7%.

Capital repaid in October

$$X\left[a^{(12)}_{83/6} - a^{(12)}_{55/4}\right] @ 7\%.$$

$$821.776\,(0.032684) = \boxed{26.859}$$

(iv) The capital repayment continued in there is installment is

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

$$821.766\left[\frac{v^{19/3} - v^{22/3}}{j^{(12)}}\right]$$

$$= \boxed{516.197}$$

Interest received $= 821.766 - 516.197$

$$= \boxed{305.569}$$ //