Assignment - 2

Q1) i) APR ≅ 2 × FLAT RATE

Loan amount = 20000

$20000 = X . a^{(12)}_{\overline{5}|}$

$20000 = 12 \times 427.90 \, a^{(12)}_{\overline{5}|}$

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

$$\text{FLAT RATE} = \frac{\text{Interest}}{\text{Initial Loan amount}} \times \frac{1}{\text{no. of years}}$$

$$= \frac{(5 \times 12 \times 427.90 - 20000)}{20000 \times 5} = 5.67\%$$

APR = $2 \times 5.67 \cong 11\%$.

ii) APR = 11%

After 1 year capital outstanding $= 12 \times a^{(12)}_{\overline{4}|}$ @ 11% $\times 427.90$

$= 16778$

Let x denote the term of new loan

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

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

$$1.108^{-x} = 0.4754$$
$$x = 7.25\text{years}$$

iii) Interest = $4\times 12\times 627.90 - 16775.68$
= 3763.22

Term = 7.25 years

Total interest = $7.25\times 12\times 274.9 - 16725.68$
= 7104.65

Payment to be made = $7104.65 - 3763.22$
= 3341.23

Q2) i) Discounted payback period - The discounted payback period is the time for which the present value of the loan up to time proceeds the present value of the cost up to time X.

Payback Period :- Payback period is same as discounted payback period, just interest rate is not taken into account.

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ii) Both payback period & discounted payback period don't give indication how profitable a project is, as they ignore cash flows after the accumulated value zero is reached.
There may not be one unique time when the balance in the investors account changes from negative to positive. However they can always be calculated.

iii) a) Internal rate of return

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

$-17000 - 20000v - 10000v^2 + 20000v + 20000v^2$
$+ 200000v^3 = 0$
$= 10v^2 + 200v^3 = 170$
$10v^2 + 200v^3 - 170 = 0$

$0.7 \rightarrow -18$
$0.9 \rightarrow -16.1$
$0.94 \rightarrow 4.9538$
$0.93 \rightarrow 0.04$
$\frac{r}{1+i} = 0.9309$

$i = 0.074229240052$
$= 7.4229240052\%$

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b) Net present value

Project A $= -170\,000 + 10000\, v^2 + 200000\, v^3 = 6823.8$

Project B $= -200000 + 14000\, a_{\overline{6}|}^{7} + 200000 v^6 = 9834.6$

c) Each project will be profitable if the rate of interest at which funds can be borrowed is less than internal rate of return.

So to be profitable, Project A requires a borrowing rate less than 7.422921. and project B requires a rate lower than 7%.

- Project A does not provide any net income during the first year.
- The lower internal rate of return for project B applies for a longer period.

Q3) Annuity $1 = 200 \times v^{(1/4)} \times \ddot{a}_{\overline{22}|}^{8\%}$

$= 200 \times v^{1/4} \times a_{\overline{22}|} \times \frac{1}{d}$

$= 200 \times 0.980944 \times 10.2007 \times \frac{0.08}{0.07407}$

$= 214.366301$

$v^{1/4} = 0.98094$

$a_{\overline{22}|} = 10.2007$

$d = 0.074074$

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

$(1+i)^{1/12} = 1.006434$
$v = 0.925926$
$i^{(4)} = 0.0777$

$= 320 \times 1.006434 \times \dfrac{1-(0.925926)^{16.25}}{0.067770}$

$= 320 \times 1.006434 \times 9.184257$

$= 2957.87008817$

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

$i^{(12)} = 0.077208$
$v = 0.925926$

$= 180 \times \dfrac{1-(0.925926)^{18.75}}{0.077208}$

$= 180 \times 9.892578702$
$= 1780.664166$

$\Lambda = \dfrac{6899.90}{1.0192427 \times 10.30886} = 656.56$

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4) $(I\ddot{a})_{\overline{n}|}$ for

$= 1 + 2v + 3v^2 + 4v^3 \dots\dots nv^{n-1}$ — (1)

$I\ddot{a}_{\overline{n}|} = (1+i)(Ia)_{\overline{n}|}$

$= (1+i) \dfrac{\ddot{a}_{\overline{n}|} - nv^n}{i}$

$= \dfrac{\ddot{a}_{\overline{n}|} - nv^n}{\frac{i}{1+i}} = \quad I\ddot{a}_{\overline{n}|} = \dfrac{\ddot{a}_{\overline{n}|} - nv^n}{d}$

6) 1) $160000 = X \; a_{\overline{10}|}^{8\%}$

$X = \dfrac{160000}{a_{\overline{10}|}} = \dfrac{160000}{6.7101} = 23844.6$

ii) Loan outstanding after 4th payment =

$23844.65 \; a_{\overline{6}|}^{@8\%} = 23844.65 \times 4.629 = 110,232$

Y be revised annual investment =

$Y a_{\overline{6}|}^{@6\%} = 110231.44$

$Y = \dfrac{110231.44}{a_{\overline{6}|}} = \dfrac{110231.44}{4.353} = 25309.44$

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iii) Loan outst @ 7th payment

$25309.7 \, a_{\overline{3}|}^{10\%}$

$= 25309.7 \times 2.486 = 6294.74$

Q7) ia) Investing in property may not be preferred alternative to investing in government securities.

Return on property is less than government securities.
Investing on property is less flexible.
Large buying and selling expenses.

b) Tender usually refers to process to whereby government and financial institution invite bids for large projects that must be submitted.
The term is set by tender.
The investors are invited to nominate the price and it is issued to the highest bidders.

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b) ADVANTAGES

They will know the price that the investor will pay at outset so it will known the cost of borrowing money. It will be administratively be less affiacit by tender.

DISADVANTAGES

Investor may be willing to pay more for the bond than the set price and so the money could be borrowed more cheaply if the tender is used.

c) Property:- Rent payments may be subject to review.

Equity :- The dividend depends on the companies performance

Index-linked bonds:- Coupon payment & Final redemption price may increase in proportion to increase in relevant index of inflation.

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8) $2.7 \quad X a_{\overline{3}|} @ i$

$1.03v^3 + \bar{a}_{\overline{10}|} (0.25v + 0.2v^2 + 0.1v^3) @ i$

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

ii) NPV =

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

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

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

$= 4.2 - 3.19$

$= 1.008$

= Should invest, as NPV is positive

9) TWRR

$$(1+i)^3 = \frac{33}{30.50} \times \frac{41.05 - 4.50}{33+1} \times \frac{45.6}{41.05} \times \frac{47}{45.6 - 2.50}$$

$(1+i)^3 = 1.08196713 \times 0.9371794872 \times 1.1084 \times 1.0904$

$(1+i)^3 = 1.22813$

$i = 0.07095281$

$i = 7.095\%$

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MWRR

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

Let $1+i=x$

$$30.5x^{3}+6x^{2.25}+4.5x^{1.5}-2.5x^{0.5}-47=0$$

$1 \Rightarrow -9$
$1.1 \to 2.9346$
$1.07 \to 0.867$
$1.072 \Rightarrow -0.00407$
$1.073 = 0.121695166$

$X = 1.07204$ $\qquad i = 0.07204$
$1+i = 1.07204$ $\qquad i = 7.204\%$.

ii) Linked rate of return

$$30.5(1+i)+6(1+i)^{0.25}=38.5$$

$1+i=x$

$$30.5x+6x^{0.25}-38.50=0$$

$1 \to -2$
$1.1 \to 1.19468$
$1.06 \to -0.081$
$1.07 \to 0.237$
$1.0626 \to 0.00172$

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$x = 1.0626$

$1+i = 1.0626$

$i = 6.26\%$

Year 2012

$38.5(1+i) + 4.50(1+i)^{0.5} = 45$

Let $(1+i) = x$

$38.5x + 4.50x^{0.5} - 45 = 0$

$1 \rightarrow -2$

$1.1 \rightarrow 2.0646$

$1.04 \rightarrow -0.37$

$1.05 \rightarrow 0.0361$

$1.0492 \rightarrow 0.00357$

$x = 1.0492$

$1+i = 1.0492$

$i = 4.92\%$

Year 2013

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

$45x - 2.5x^{0.5} - 47 = 0$

$1.1 \rightarrow -0.122$

$1.2 \rightarrow 4.2013$

$1.1028 \rightarrow 0.00064$

$1.10279 \rightarrow 0.0002047$

$X = 1.10279$

$1+i = 1.10279$

$i = 10.279\%$

Linked rate of return

$(1+i)^3 = (1.0626) \times (1.0492) \times 1.10279$

$= 1.22947827$

$1+i = 1.071289$

$i = 7.1289\%$

iii) TWRR eliminates the effect of cash flow amount and timing and gives a fairer basis for assessing the investment performance for the fund. MWRR is sensitive to amount of net cash flows.

10) i) Let loan amount be Rs L

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

$P = 0.12$

$d = 0.107143$

$a_{\overline{15}|} = 6.8109$

$V = 0.892859$

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$$L = 180000 \times 6.8109 + 20000 \times \left[\frac{\ddot{a}_{\overline{n}|} - 15v^{15}}{i} \right]$$

$$= 180000 \times 6.8109 + 20000 \left(\frac{4.8878}{0.12} \right)$$

$$= 1225962 + 20000 \times 40.733$$
$$= 2040587.4$$

$$\text{Total cost} = \frac{2040587.4}{0.8} = ₹2550734.25$$

ii) The loan outstanding @ 9th year

$$L = (180000v + 180000v^2 \dots 180000v^7)$$
$$+$$
$$[(9 \times 20000v) + (10 \times 20000v^2) \dots (15 \times 20000v^7)]$$

$$L(9) = 340000 a_{\overline{7}|} + 20000 (Ia)_{\overline{7}|} \text{ @12\%}$$
$$L(9) = 340000 \times 4.5638 + 20000 \left(\frac{5.1114 - 7 \times 0.45235}{0.12} \right)$$

$$L(9) = 1551672 + 324158.3 = 1875850.3$$

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iii) Let new installment be Rs P

$1569866.65 = P\, a_{\overline{5}|} @ 10\%$

$1569866.65 = P \times 3.790788$

$P = 414126.867$

Extra payment by Mr Sam if the loan continued with the first Bank :

Total installment - Loan outstanding at end of 10th year

$= (400000 + 420000 + 440000 + 460000 + 480000) - 1569866.65$

$= 630133.35$

Extra payment made by Mr Sam : 2nd Bank

Total installment + 1% processing fee - Loan o/s at end of 10th year

$= 5 \times 414126.90 + 0.01 \times 1569866.65 - 1569866.65$

$= 516466.35$

∴ Extra payment to 2nd Bank is lower.

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12) i) The DPP of an investment project is the first time when the net present value of the cash flow from the project is positive.

ii) a) $-800000(1+i)^t \cdot 50000(1+i)^{t-1} + 100000\, s_{\overline{t-2}|}$ @7%

$= -800000(1.07)^t \cdot 50000(1+i)^{t-1} + 100000 \times \dfrac{(1+0.07)^{t-2}-1}{\log(1+i)}$

$t \to 17 \to -74.29$
$18 \to 23.462$
$17.8 \to 3.24$
$17.768 \to 0.0426$

$\therefore t = 17.768$ years

b) Accumulated profit

$100000\, s_{\overline{4.233}|}$ @6% $= \dfrac{100000 \times (1+0.06)^{4.233} - 1}{\log(1.06)}$

$= 480,074.3066$

Accumulated amount $= 4800743.3066$

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iii) $100\,\bar{s}_{\overline{1}|} = 100 \times \dfrac{(1+0.06)^1 - 1}{\log(1.06)}$

$= 100 \times 1.0297086$

$= 1,02,970.86$

The DPP is the smallest integer,

$-800(1+i)^t - 500(1+i)^{t-1} + 102,9708\, s_{\overline{t-2}|}\ @7\% > 0$

$-800000(1.07)^t - 500000(1.07)^{t-1} + 1029708 \times \dfrac{(1.07)^{t-2} - 1}{0.07}$

$t \to 17 \to -8.7\%$
$t \to 18 \to 9,78\,66$

$\therefore$ 4, 18 years

$\therefore$ The balance in the account after 18 years:

$-800,000(1+i)^{18} - 50000(1+i)^{17} + 102,9715_{\overline{16}|}$

$= 977896$

Accumulated value

$= 977896(1+i)^4 + 100000\,\bar{s}_{\overline{4}|}\ @6\%$

$s_{\overline{4}|} = 4.3746$
$s = 0.058269$

$= 462801.35$

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13) i)

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

$p^{(12)} = 0.067850$

$a'_{\overline{25}|} = 11.653$

$$X\, a_{\overline{25}|} \times \frac{i}{i^{(12)}} = 9880$$

$$X\,(11.6536) \times \frac{0.07}{0.067850} = 9880$$

$X = 821.7669$

$X/_{12} = 68,48,057$

ii) Loan o/s after payment on 10th March

$$= 8,21,766.9 \times \frac{\left(1 - \left(\frac{1}{1+0.07}\right)^{34/3}\right)}{0.06785}$$

$= 648574.53$

Total interest $= 8217669 - 5161973.8 = 3055695.2$

iii)

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

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$$X\left[\frac{v^{13.75} - v^{83/6}}{i^{(12)}}\right]$$

$$X\left[\frac{(1/1.07)^{13.75} - (1/1.07)^{83/6}}{0.06785}\right]$$

$821766.9096 \; (0.032684) = \cancel{26858.02} \; 26858.1296$

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

$$= 821{,}766.909 \left[\frac{v^{19/3} - v^{22/3}}{i^{12}}\right]$$

$$= 821766.909 \left[\frac{(1/1.07)^{19/3} - (1/1.07)^{22/3}}{0.06785}\right]$$

$= 5{,}16{,}197.3861$