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Assignment 2.

Q1) i) APR $\approx \frac{\text{average annual interest}}{\text{average loan amount}} = \frac{\text{average annual interest}}{\frac{1}{2} \times \text{original loan}} = \frac{2 \times \text{average annual interest}}{\text{original loan}}$

or $2 \times$ Flat rate.

∴ Original loan amount = Rs 20,000

$20000 = 12 \times 427.90\, a_{\overline{5}|}^{(12)} \Rightarrow a_{\overline{5}|}^{(12)} = 3.8499.$

Flate rate $= \frac{\text{total interest}}{\text{loan} \times \text{total years}} = \frac{(5 \times 12 \times 427.90 - 20000)}{20000 \times 5} = 5.67\%$

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

or by calalator

$i = 11\%,\ a_{\overline{5}|}^{(12)} = 3.87872.$

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

Interpolating APR, I is $\frac{i - 10\%}{3.8499 - 3.96154} = \frac{11\% - 10\%}{3.87872 - 3.96514}$

$i = 10.8\%$

At 10.8%, $12 \times 427.90\, a_{\overline{5}|}^{(12)} = 20000.2$

At 10.9%, $12 \times 427.90\, a_{\overline{5}|}^{(12)} = 19958.2$

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

ii) APR $= 10.8\%$

After 1 year capital left to pay $= 12 \times a_{\overline{4}|\,@10.8}^{(12)} \times 427.90 = 16775.98.$

Let t denote the term of new loan then

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

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

$1.108^{-t} = 0.4754$

$t = 7.25$ years.

iii) The original loan had 4 years of payments remaining thus.

Total Interest $= 4 \times 12 \times 627.90 - 16775.68$

$= 3763.22$.

New loan has a term of 7.25 years hence

Total Interest $= 7.25 \times 12 \times 274.49 - 16775.68$

$= 7104.65$.

They will have to pay $(7104.65 - 3763.22)$ 3341.23 more interest under

Q2 i) a Discounted payback period- The discounted payback period is the time t for which the present (or accumulated) value of the r up to time t exceeds the present (or accumulated) value the cost up to time t.

b Payback period:- The payback period is the same as the discoun payback period, except the present value calculation is carri out using an interest rate of 0. In other words, it is the ea time for which the monetary value of the return exceeds the ~~net~~ monetary value of the costs.

ii) Unlike the NPV, neither the DPP nor the PP give an 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 investor's account changes from negative to postive. However N can ~~als~~ always be calculated.

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

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

iii) a) Interal rate of return

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

$-170000 - 20000v + 10,000v^2 + 20000v + 20000v^2 + 200000v^3 = 0$

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

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

$0.9 \rightarrow -16.1$

$1 \rightarrow 40$

$0.93 \rightarrow -0.479$

$0.94 \rightarrow 4.9538.$

$0.9309 \rightarrow 0.0046$

$\therefore v = 0.9309$

$\frac{1}{1+i} = 0.9309$

$i = 0.07422924052$

$i = 7.422292\% = 7.4\%.$

So IRR for Project B is exactly ~~7%~~ 7.4%

$14a_{\overline{6}|} + 200v^6 = 200$

b) Net Present Value.

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

Project A : $NPV = -170\,000 + 10000v^2 + 200000v^3 = 6823.82.$

Project B $NPV = -200000 + 14000a_{\overline{6}|} + 200000v^6 = 9834.645$

c) Maximum Interest Rate beyond which 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 7.42292% and Project B requires a rate lower than 7%.

Other factors to be considered include:-

- 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

- Rate of interest available in years 4 to 6 (i.e after Project A is finished) will affect the comparison between the accumulated profit at the end of year 6.
- The risk associate with the receipt of income. If Project greater uncertainty or risk, it may not be accepted even it has a higher IRR.

3) Value of 1st November 1985 is

Annuity 1 = $200 \times v^{(1/4)} \times \ddot{a}_{22}$ at 8% $v^{1/4} = 0.980944$

$= 200 \times v^{1/4} \times a_{\overline{22}|} \times \frac{i}{d}$ $a_{\overline{22}|} = \cancel{10.6748}$ 10.2007

$d = 0.074074$.

$= 200 \times 0.980944 \times 10.\cancel{6748}\,2007 \times \frac{0.08}{0.074074}$

$= 2161.366301$

Annuit 2 = $320\,(1+i)^{1/12} \times a^{(4)}_{\overline{16.25}|}$ at 8% $(1+i)^{12} = 1.006434$

$= 320 \times 1.006434 \times \frac{1-(0.925926)^{16.25}}{0.0777706}$ $V = 0.925926$

$i^{(4)} = 0.077706$

$= 320 \times 1.006434 \times 9.184257$

$= 2957.870081$.

Annuity 3 = $180 \times a^{(12)}_{\overline{18.75}|}$ $i^{(12)} = 0.077208$

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

$= 180 \times 9.892578702$

$= 1780.664166$.

Let the revised annuity be A

Value of revised annuity is $\cancel{X}(1+i)^{1/4} \times a^{(2)}_{\overline{21.5}|}$ $(1+i)^{1/4} = 1.019$ $i^{(2)} = 0.0\ldots 401$

$A = \frac{6889.90}{1.019427 \times 10.30886}$

$= 656.56$

4) $(I\ddot{a})_n$ for $i>0$

1 2 3 4 .. n

0 1 2 3 n-1 n

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

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

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

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

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

OR

Multipying both sides by v

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

Subtracting

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

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

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

$(I\ddot{a}_{\overline{n}|}) = \dfrac{\ddot{a}_{\overline{n}|} - nv^n}{d}.$

5) Time-weighted rate of return for each fund for the year 2014

Property Fund $\dfrac{16.4}{12.4} - 1 = 0.3226$ or 32.26

Equity Fund $\dfrac{15.5}{12.1} - 1 = 0.2810$ or 28.10%.

ii)

a) Assuming that the investor bough 100 units per quarter in property fund the equation of value is given by

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

Let $1+i = x$.

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

$124x + 131x^{3/4} + 148x^{1/2} + 158x^{1/4} - 656 = 0.$

~~x~~ $0.3 \rightarrow -32.9$

$0.4 \rightarrow 125.1457076$

$0.32 \rightarrow -0.2907$

$0.33 \rightarrow 15.0009$

$0.321 \rightarrow 0.6862$

$0.322 \rightarrow 2.2797$

$0.3211 \rightarrow 0.8456$

$0.32101 \rightarrow 0.7022$

$1 \to -95$ | $1.293 \to -0.049$
$1.2 \to -29.51$ | $1.294 \to 0.2638$
$1.3 \to 2.145$ | $1.2931 \to -0.018$
$1.29 \to -0.991$ | $1.2932 \to 0.0126\ldots$
$1.3 \to 2.145$

$\therefore x \approx 1.2932$

$1+i \approx 1.2932$

$\boxed{i \approx 29.32\%}$

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

$400 \times \ddot{s}_1^{(4)} = 100 \times 16.4\left(\frac{1}{12.4} + \frac{1}{13.1} + \frac{1}{14.8} + \frac{1}{15.9}\right)$

$\ddot{s}_1^{(4)} = \frac{100 \times 4.72051784}{400}$

$\ddot{s}_1^{(4)} = 1.1801$

$\frac{(1+i)^{n}-1}{d^{(4)}} = 1.801$

$\frac{(1+i)^n - 1}{i^{(4)}} \quad \frac{1+i-1}{i^{4}} = 1.801$

$i/i^{(4)} = 1.801$

$\frac{i}{4[(1+i)^{1/4}-1]} = 1.801$

$\frac{i}{4[(1+i)^{1/4}-1]} - 1.801 = 0$

$i^{(4)} = 4$

$\left(1+\frac{i^{(4)}}{4}\right) = (1+i)$

$1+\frac{i^{(4)}}{4} = (1+i)^{1/4}$

$i^{(4)} = 4[(1+i)^{1/4} - 1]$

$\frac{(1+i)^1 - 1}{4(1-(1/1+i)^{1/4})} = 1.1801$

$\frac{x-1}{4(1-(1/x)^{1/4})} - 1.1801$

$i \to 2 \to -0.0219$
$i \to 2.9 \to -0.0012$
$i \to 3 \to 0.0866017178$

$i \to 2.95 \to -0.001224$
$i \to 2.96 \to 0.00095671$
$i \to 2.956 \to 0.0000845698$

$\therefore i = 2.956\%$

$i \to$
$1.2 \to -0.057$ | $1.29 \to -0.004$
$1.3 \to 0.0012$ | $1.297 \to -0.0005$
$1.2978 \to -0.00003$ | $1.298 \to 0.000084$
$1.2979 \to 0.000026$

$1+x = 1.2979$

$\boxed{i = 0.2979 \text{ or } 29.79\%}$

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

Let $1+i = x$

$1210x + 920x^{3/4} + 1030x^{1/2} + 1310x^{1/4} - 6200 = 0$

$121x + 92x^{3/4} + 103x^{1/2} + 131x^{1/4} - 620 = 0$

$x \to 1.6 \to -17.89$ $\quad$ $x \to 1.6673 \to -0.021$

$x \to 1.7 \to 6.5487$ $\quad$ $x \to 1.674 \to 0.2224$

$x \to 1.67 \to -0.752$ $\quad$ $x \to 1.6731 \to 0.0030422268957$

$x \to 1.68 \to 1.6841$

$\therefore x = 1.6731$

$1+i = 1.6731$

$i = 0.6731 = \underline{67.31\%}$

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

$\ddot{s}_{\overline{1}|}(4) = \frac{15.5}{4}(0.0826446281 + 0.1086956522 + 0.0970873786 + 0.0763358778 6)$.

$\ddot{s}_{\overline{1}|}^{(4)} = \frac{15.5}{4}(0.3647635368)$

$\ddot{s}_{\overline{1}|}^{(4)} = 1.413458705$

$\frac{(1+i)-1}{d^{(4)}} = 1.413458705.$ $\quad$ $d^{(p)} = p\left[1 - \left(\frac{1}{1+i}\right)^{1/p}\right]$

$\frac{(1+i)-1}{4\left[1-\left(\frac{1}{1+i}\right)^{1/4}\right]} - 1.413458705 = 0.$

Let $1+i = x$

$\frac{x-1}{4\left(1-\left(\frac{1}{x}\right)^{1/4}\right)} - 1.413458705 = 0.$

$1.7 \to -0.00496$ $\quad$ $1.71 \to 0.000055$ $\quad$ $1.7089 \to 0.0000511344132$

$1.8 \to 0.0498$ $\quad$ $1.708 \to -0.00005$ $\quad$ $\therefore 1+i = 1.7089$

$1.709 \to 0.0000035$ $\quad$ $i = 0.7089$ or $\underline{70.89}$

6) i) Let x be the inital annual repayment

$160000 = x a_{\overline{10}|}$ @ 8%

$x = \frac{160000}{a_{\overline{10}|}} = \frac{160000}{6.7101} = 23,844.65.$

ii) The loan outstanding immediately after 4^{th} payment is

$23844.65\, a_{\overline{6}|}$ @8% $= 23844.65 \times 4.6229 = 110,231.442.$

Let y be the revised annual instalment. The equation of value

$y a_{\overline{6}|} = 110231.44$ @ 10%

$y = \frac{110231.442}{a_{\overline{6}|}} = \frac{110231.442}{4.3553} = 25309.72.$

iii) The loan outstanding immediately after 7^{th} payment is

$25309.72\, a_{\overline{3}|}$ @ 10%

$= 25309.72 \times 2.4869 = 62942.74$

Let z be the revised annual instalment

$z a_{\overline{3}|} = 62,942.74$ @9%

$z = \frac{62,942.74}{a_{\overline{3}|}} = \frac{62942.74}{2.5313} = 24865.77.$

The yeild can be found as.

$160000 + 1465.07 a_{\overline{4}|} - 443.95 \times a_{\overline{7}|} - 24865.77 a_{\overline{10}|} = 0$

$160,000 + 1465.07 \left(\frac{1-v^4}{i}\right) - 443.95 \left(\frac{1-v^7}{i}\right) - 24865.77 \left(\frac{1-v^{10}}{i}\right)$

$160,000 + 1465.07 \left(\frac{1-(1/1+i)^4}{i}\right) - 443.95 \left(\frac{1-(1/1+i)^7}{i}\right) - 24865.77 \left(\frac{1-}{}\right.$

8% → −4310.73

9% → 29300.938

$\cancel{9\% - 8\%}$

$\cancel{29300.938 + 4310.73}$

0.08 →

Doubt

Investing in property may not be preferred alternative to investing in Govement securities.
The return on property is lower than that in Govement security
It is difficult to invest in property
Less flexible because of the large unit size.
The market ability for property is poor.
Large buying and selling expenses.

Tender usally refers to process whereby govement and financial institutions invite bids for large projects that must be submitted within a finite deadline. Govement may raise money by floating a loan or stock exchage. The term of the issue are set out by tender. The investors are invited to nominate the price and it is issued to the highest bidders.

Advantages : for Govement :- They will know the price that the investor will pay at outset so it will know the cost of borrowing money
~~for investors~~:- It will be administratively less difficult by tender.
~~Dis~~ 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~~ if the tender is used.
Insufficient investor may be prepared to pay the set price causing only part of the offer to be sold and Govement may not meet its financial requirement.

The securities with uncertain returns are as follows:-
Equity:- The dividend depends on the companies performance.
Property- ~~May~~ Rent payments may be subject to review.
Index-linked bonds : coupon payment and final redemption price may increase in proportion to increase in relevant index of inflation.

8) i) The present value of outlay is

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

The expected present value of the income is:-

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

Equating the present value of the outlay to the present value of the income

$2.7 + 0.2a_{\overline{3}|} = \cancel{1.03}\ 0.1v^3 + \bar{a}_{\overline{10}|} (0.25v + 0.2v^2 + 0.1v^3) @ i$

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

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

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

$= 0.1 \times 0.7513 + 0.85 \times 0.7513 \times 6.4469 - 2.70 - \cancel{2}0.2 \times 2.04868$

$= 4.19 - 3.19$

$= 1.0089$

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

9) TWRR

$$(1+i)^3 = \frac{33}{30.50} \times \frac{41.05 - 4.5}{33+6} \times \frac{45.6}{41.05} \times \frac{47}{45.6 - 2.50}$$

$(1+i)^3 = 1.08196713 \times 0.937179 4872 \times 1.11084 0438 \times 1.090487$

$(1+i)^3 = 1.2281327.$

$(1+i) = 1.070951281$

$i = 0.070951281$

TWRR = 7.0951281%

MWRR

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

Let $1+i = x$

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

$1 \to -9$

$1.1 \to 2.9346$

$1.07 \to -0.867$

$1.08 \to 0.3782$

$1.076 \to \cancel{-0.122}$

$1.077 \to 0.002313506$

$1.072 \rightarrow -0.00407103193$ $\quad$ $1.0721 \rightarrow 0.00084958729089$

$1.073 \rightarrow 0.1216951665.$ $\quad$ $1.07204 \rightarrow 0.000955463106.$

$x = 1.07204$ $\quad$ $i = 0.07204$

$1+i = 1.07204$ $\quad$ $\boxed{i = 7.204\%}$

ii Linked rate of return

Year 2011 - Equation of value

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

Let $(1+i) = x$

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

$1 \rightarrow -2$ $\quad$ $1.062 \rightarrow -0.018$

$1.1 \rightarrow 1.0194682135.$ $\quad$ $1.063 \rightarrow 0.0138$

$1.06 \rightarrow -0.081$ $\quad$ $1.0625 \rightarrow -0.00002120445693$

$1.07 \rightarrow 0.2373$ $\quad$ $1.0626 \rightarrow 0.0001072882008$

$x = 1.0626$

$1+i = 1.0626$

$\boxed{i = 0.0626 \text{ or } 6.26\%}$

Year 2012 Equation of value.

$38.50(1+i) + 4.50(1+i)^{0.5} = 45$

Let $(1+i) = x$

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

$1 \rightarrow -2$ $\quad$ $1.049 \rightarrow -0.0045684$

$1.1 \rightarrow 2.0696$ $\quad$ $1.0492 \rightarrow 0.00035708899029$

$1.04 \rightarrow -0.37$

$1.05 \rightarrow 0.0361$

$x = 1.0492\%$

$1+i = 1.0492$

$\boxed{i = 0.0492 \text{ or } 4.92\%}$

Year 2013 – equation of value.

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

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

$1.1 \rightarrow -0.122$ $\quad$ $1.11 \rightarrow 0.316$ $\quad$ $1.103 \rightarrow 0.0094048$

$1.2 \rightarrow 4.2013$ $\quad$ $1.102 \rightarrow -0.034404..$ $\quad$ $1.1027 \rightarrow -0.00373$

$1.1028 \rightarrow 0.000642881435$ $\quad$ $1.10279 \rightarrow 0.0002047846045$

$x = 1.10279$

$1+i = 1.10279$

$\boxed{i = 0.10279 \text{ or } 10.279\%}$

Linked rate of return

$(1+i)^3 = (1.0626) \times (1.0492) \times 1.010279).$

$(1+i)^3 = 1.229478427$

$1+i = 1.071289803$

$\boxed{i = 0.071289803 \text{ or } 7.1289803\%}$

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

10) i) Let loan amount be Rs L

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

$\ddot{a}_{\overline{n}|} = a_{\overline{n}|} \times \frac{i}{d}$

$i = 0.12$

$d = 0.107143$

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

$v = 0.892857$

$L = 180000 \times 6.8109 + 20000 \times 40.7340 \left[\frac{\ddot{a}_{\overline{n}|} - 15v^{15}}{i}\right]$

$= 180000 \times 6.8109 + 20000 \times \left(\frac{4.887760487}{0.12}\right)$

$= 1225962 + 20000 \times 40.73133739$

$= 1225962 + 814626.7479$

$= \underline{\underline{2040588}}$

Total cost of house $= \frac{2040588}{0.8} = 2550735$

ii) The loan outstanding at the beginning of the 9th year.

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

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

$L(9) = 340{,}000 \times 4.5638 + 20000 \left(\frac{5.1114 - 7 \times 0.45235}{0.012}\right)$

$L(9) = 1551672 + 324158.33 =$ Rs $1875{,}850.33$

Loan schedule

Year	Loan o/s	Loan Installment	Interest	Capital Repayment
9	18,75850.33	360000	225102.04	134897.96
10	1740952.37	380000	208914.28	171085.72
11	1569,866.65			

iii) Let the new installment be Rs P

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

$1569866.65 = P \times 3.790786$

$P = 414126.887$

Extra payment by Mr Sam if the loan continued with the first bank:
Total installment − loan outstanding at the end of 10th year.
$= (400000 + 420000 + 440000 + 460000 + 480000) - 15,69,866.65$
$= 6,30,133.35$
Extra payment made by Mr Sam if the loan transferred to 2nd bank:
Total installment + 1% processing fees − Loan O/S at the end of 10th year
$= 5 \times 414126.90 + 0.01 \times 1569866.65 - 1569866.65$
$= 2070634.337 + 15,698.665 - 1569866.65$
$= 5,16,466.35$

$\therefore$ the extra payment (Interest + processing fee) to 2nd bank is lower than the payment to the first bank, it is advisable to Mr Sam to change his loan to 2nd bank.

11) i) Time weighted rate of return is given by:

$$(1+i)^2 = \frac{\cancel{500}}{46\cancel{0}} \times \cancel{600}\left(\frac{550+50}{500+40}\right) \times \frac{x}{\cancel{550}_{11}}$$

$$(1+i)^2 = \frac{600 \times x}{46 \times 540 \times 11}$$

$$(1+i)^2 = 1.44$$

$$\frac{1.44 \times 46 \times 540 \times 11}{600} = x$$

$$\boxed{x = 655.776}$$

ii) Money weighted rate of return is given by equation.

$$460(1+i)^2 + 40(1+i)^{7/4} - 50(1+i) = 655.776$$

Let $1+i = x$

$$460x^2 + 40x^{7/4} - 50x - 655.776 = 0.$$

$1.1 \to -106.915622$	$1.198 \to -0.609$
$1.2 \to 1.6575.$	$1.199 \to 0.5237$
$1.19 \to -9.6356$	$1.1985 \to -0.00427895241$
	$1.1986 \to 0.0704$
	$1.19854 \to 0.00025233$

$(1+i) = 1.19854$

$i = 0.19854$

$\boxed{i = 19.854\%}$

iii) The effective rate of return for year 2015 is given by solving the equation of value:-

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

$460x + 40x^{3/4} - 600 = 0.$

$1.2 \rightarrow -2.138$ $\quad$ $1.204 \rightarrow -0.184$ $\quad$ $1.20438 \rightarrow 0.0015420$

$1.3 \rightarrow 46.698$ $\quad$ $1.205 \rightarrow 0.3044$

$1.21 \rightarrow 2.7475$ $\quad$ $1.2044 \rightarrow 0.01131475$

$1.2043 \rightarrow -0.037.$

$1+i = 1.202438$

$\boxed{i = 0.202438 \text{ or } 20.2438\%}$

Effective rate of return for the year 2016.

$(1+i) = \frac{655.78}{550} = 1.92327$

So linked rate of return is

$(1+i)^2 = 1.92327 \times 1.202438$

$(1+i)^2 = 1.436015121.$

$1+i = 1.198338483$

$\boxed{i = 0.198338483 = 19.8338483\%}$

LIRR = 19.8338483%

iv) When the sub-intervals chosen for calculating LIRR coincide with the interval between net cash flow being received then the Linked Internal rate of return will be identical to time weighted rate of return.

v) ① TWRR is a better measure of fund manager's performance.

② MWRR is sensitive to the amount and timing of net cash flows, but fund manager does not have any control on them.

(3) TWRR is calculated using "growth factors" reflecting the change in fund value between the time of consecutive cash flows. Thus TWRR is independent of amount and timing of cash-flows.

(4) Hence TWRR is better measure of fund managers performance.

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

ii a) Let us work in units of 1000

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

$$-800(1+i)^t - 50(1+i)^{t-1} + 100 \times \frac{(1+i)^{t-2}-1}{\delta} = 0.$$

$$\delta = \ln(1+i)$$

$$-800(1.07)^t - 50(1.07)^{t-1} + 100 \times \frac{(1.07)^{t-2}-1}{\ln(1.07)} = 0$$

$t \to 17 \longrightarrow -74.079$ $17.76 \longrightarrow -0.757$

$18 \longrightarrow 23.4626$ $17.77 \longrightarrow 0.2426$

$17.7 \longrightarrow -6.741$ $17.767 \longrightarrow -0.057$

$17.8 \to 3.246Q2$ $17.768 \to 0.0426$

$\therefore t = 17.767$ years

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

$$100\,\bar{s}_{\overline{4.233}|} \text{ at } 6\% = 100 \times \frac{(1+0.06)^{4.233}-1}{\ln(1.06)}$$

$$= 480.0743066$$

Accumulated amt = 480,074.3066 Rs

iii The businessman may accumpulate his rental income for each year @ 6%

$100\bar{s}_{\overline{1}|} = 100 \times \frac{(1+0.06)^1 - 1}{\ln(1.06)}$

$= 100 \times 1.029708672$

$= \underline{102.9708672}$

The DPP is smallest integer.

$-800(1+i)^t - 50(1+i)^{t-1} + 102.9708\, s_{\overline{t-2}|}$ @ 7%. 70.

$-800(1.07)^t - 50(1.07)^{t-1} + 102.9708 \times \frac{(1.07)^{t-2} - 1}{\ln(1.07)\ 0.07} > 0$

$t \rightarrow 16 \rightarrow -97.28$ $\quad$ $t \rightarrow 17 \rightarrow -87.1$

$t \rightarrow 17 \rightarrow 2.4384$ $\quad$ $t \rightarrow 18 \rightarrow 9.7866$

$t \rightarrow 16 \rightarrow -97.28$

$t \rightarrow 17 \rightarrow 2.4384.$ $\quad$ $\boxed{\therefore t = 18 \text{years.}}$

The balance in the businessmans acount after transtation at 18years is

$-800(1+i)^{18} - 50(1+i)^{17} + 102.971\, s_{\overline{16}|} = \cancel{9.7686603448}.$

$-2703.945821 - 157.9407 + \cancel{7407106}\ 2871.0665545 \cancel{67882}$

$= 9.77896$

Accumulated value after 22 years is

$9.77896(1+i)^4 + 100\bar{s}_{\overline{4}|}$ @ 6%

$\cancel{12.4681822695} + 100 \times s_{\overline{4}|} \times \frac{i}{\delta}$

$= 12.34571169 + 450.4556454$

$s_{\overline{4}|} = \cancel{4.04399}\ 4.3746$

$\delta = \cancel{0.067659}\ 0.058269$

$= 462.893571$

Accumulated amount after 22 year is 462,801.3571

13) i) Let $x/12$ be the monthly repayment. Solving the equation

$i^{(12)} = 0.067850$

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

$a_{\overline{25}|} = 11.6536$

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

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

$X = 821.7669096.$

$x/12 = 68.48057558.$

Hence the monthly repayment 6848.05758

ii Loan o/s immediately after repayment on 10th March 2029.

$X\ddot{a}^{(12)}_{\overline{34/3}|} = \cancel{64}\ \cancel{6848.05758}\ \overset{821.7669096}{} \times \frac{(1-(1/1.07)^{34/3})}{0.067850}$

$=$ 6485.745315 (in thousands)

$=$ ~~6485,745.315~~ 648,574.5315

iii The loan o/s just after the repayment on 10th September 2026 is made:

$Xa^{(12)}_{\overline{83/6}|}$ @ 7%

The loan o/s just after the repayment on 10th Octorba 2026 is made

$Xa^{(12)}_{\overline{55/4}|}$ @ 7%

$\hookrightarrow Xa^{(12)}_{\overline{13.75}|}$ @ 7%

Capital repaid on 10th October 2026 is thus

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

$i^{(12)}$ ~~= 0.06816~~

$X\left[\frac{v^{13.75} - v^{83/6}}{i^{(12)}}\right]$ @ 7%

$X\left[\frac{(1/1.07)^{13.75} - (1/1.07)^{83/6}}{\cancel{0.06816}\ 0.067850}\right]$

$821.7669096\left(0.03268447611\right) = \underline{26.85902093.}$

iv The capital repayment continued in these 12 instalment is

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

$$821.7669096\left[\frac{v^{19/3} - v^{22/3}}{i^{(12)}}\right]$$

$$821.7669096\left(\frac{(1/1.07)^{19/3} - (1/1.07)^{22/3}}{0.067850}\right)$$

$= 516.1973861$

ii) Total interest in these 12 instalment is

$821.7669096 - 516.1973861 = \underline{\underline{305.5695235}}$