

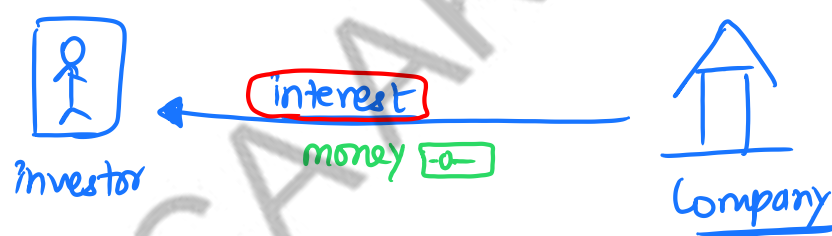
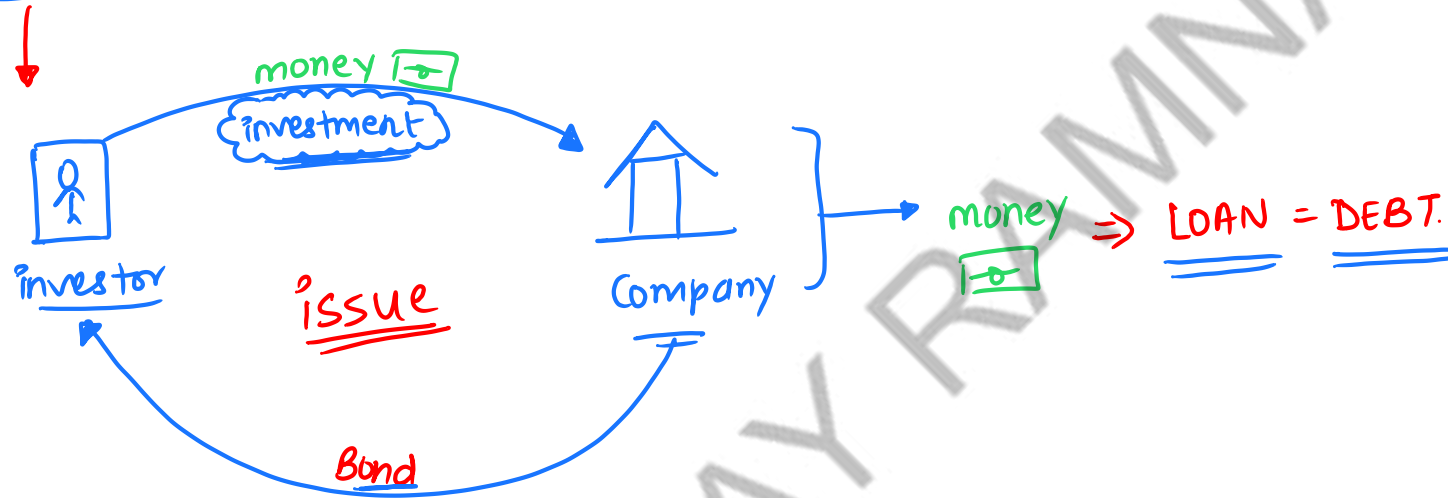
BOND

VALUATION

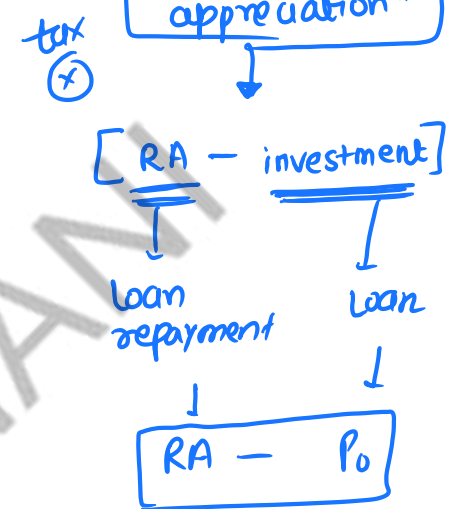
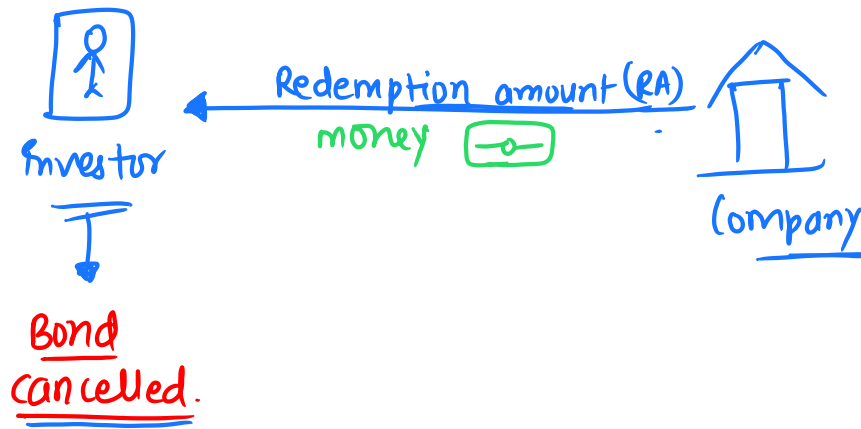
CA AKSHAY RAMNIANI

BOND VALUATION

Debentures,
Debt instruments etc, Govt Bonds

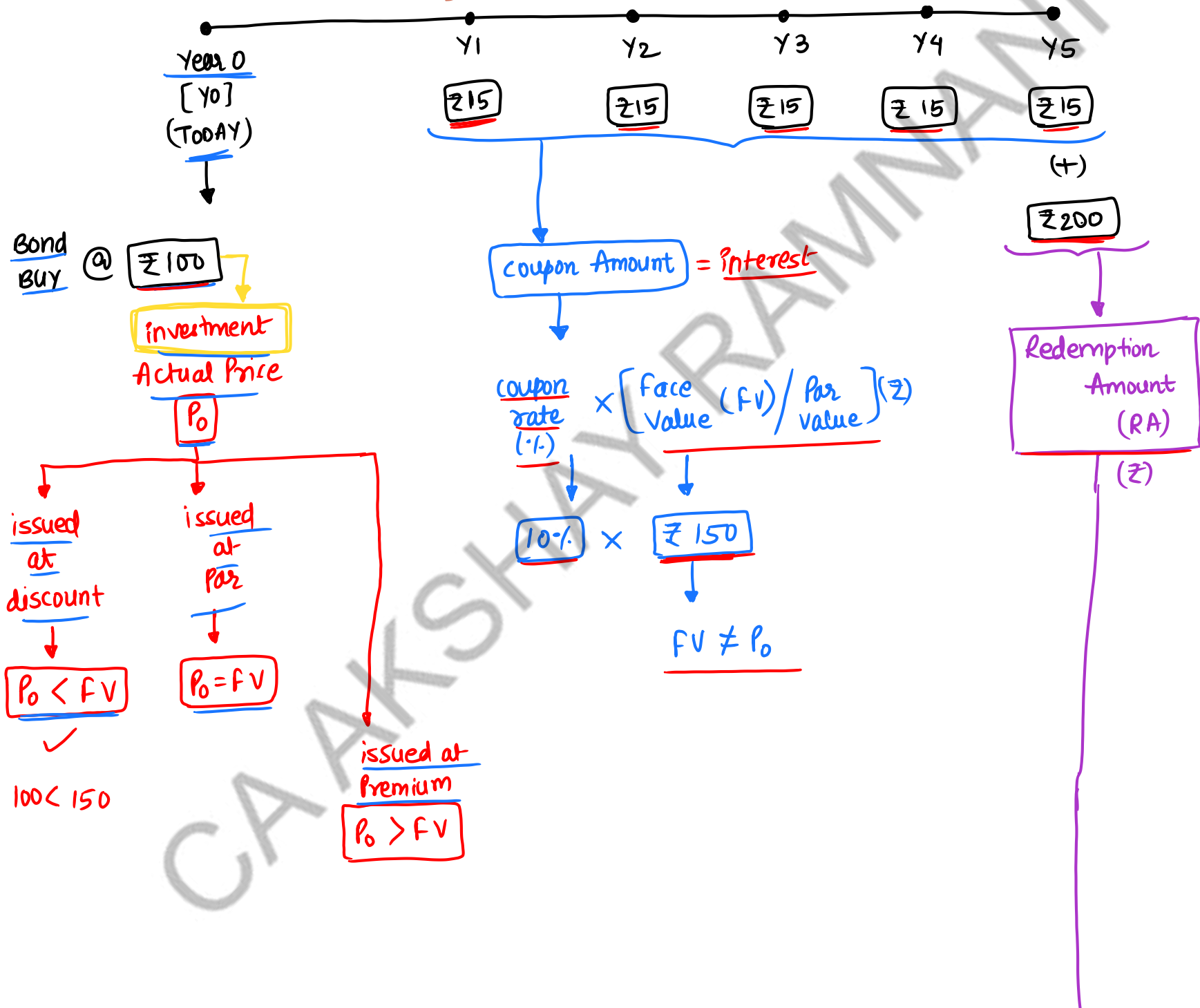


investor Return = $\boxed{\text{interest}} + \boxed{\text{capital gain}}$



Example:-

'n' = Maturity Period = 5 years



redeemed
at
discount

$$RA < FV$$

redeemed
at
Par

$$RA = FV$$

redeemed
at
Premium

$$RA > FV$$



$$200 > 150$$

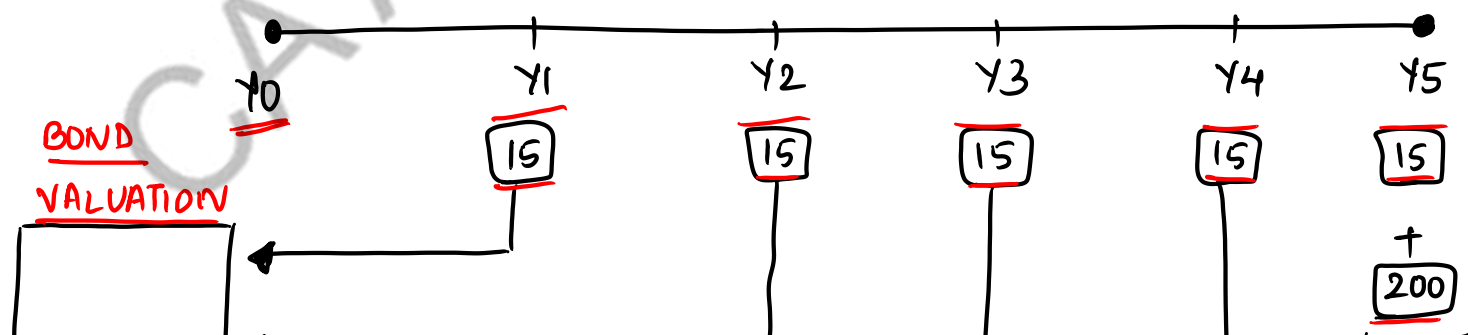
BOND VALUATION

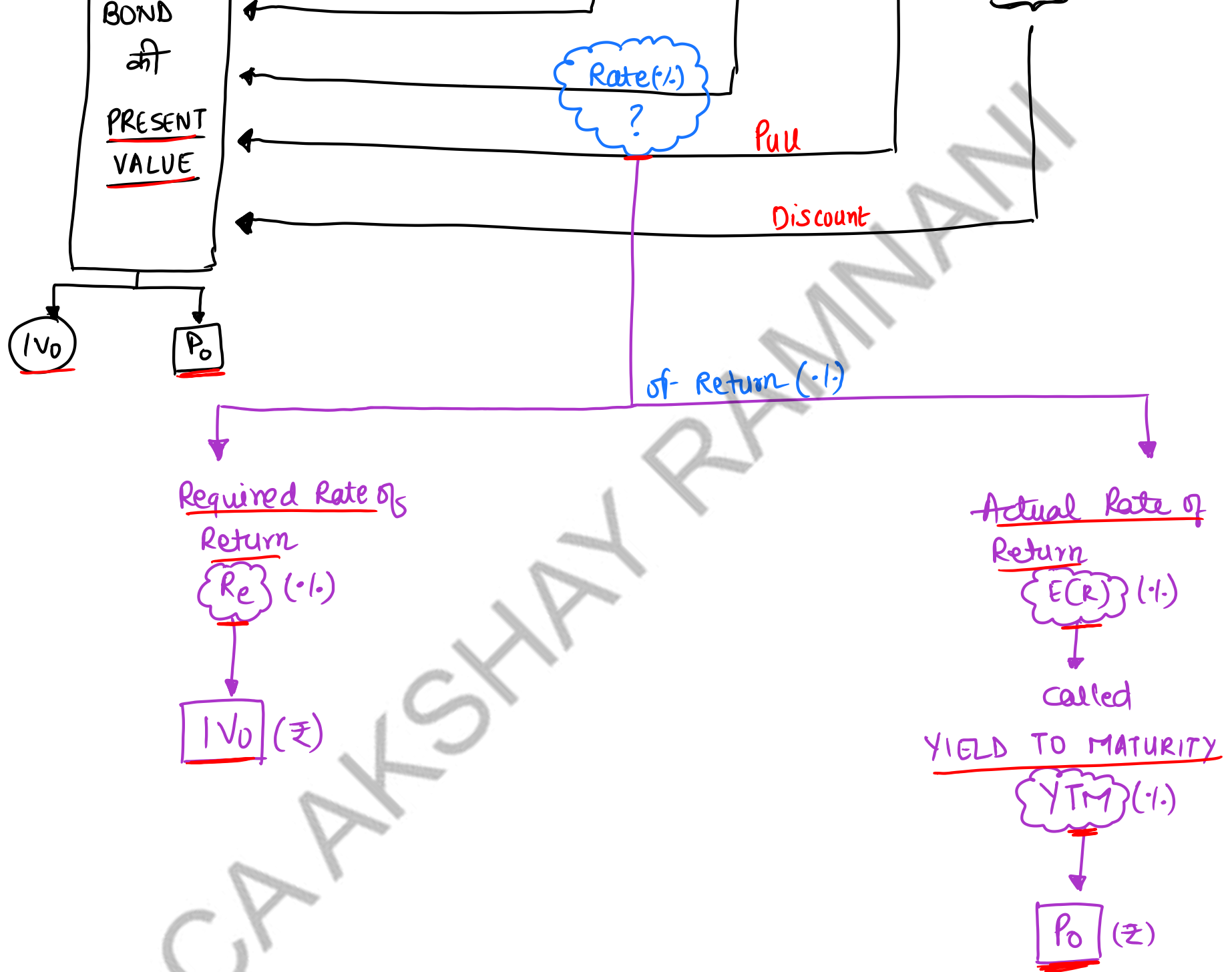
"Bond at PRESENT VALUE"

FUNDAMENTAL ANALYSIS

Intrinsic Value
 IV_0

Actual Value /
Actual Price
 P_0



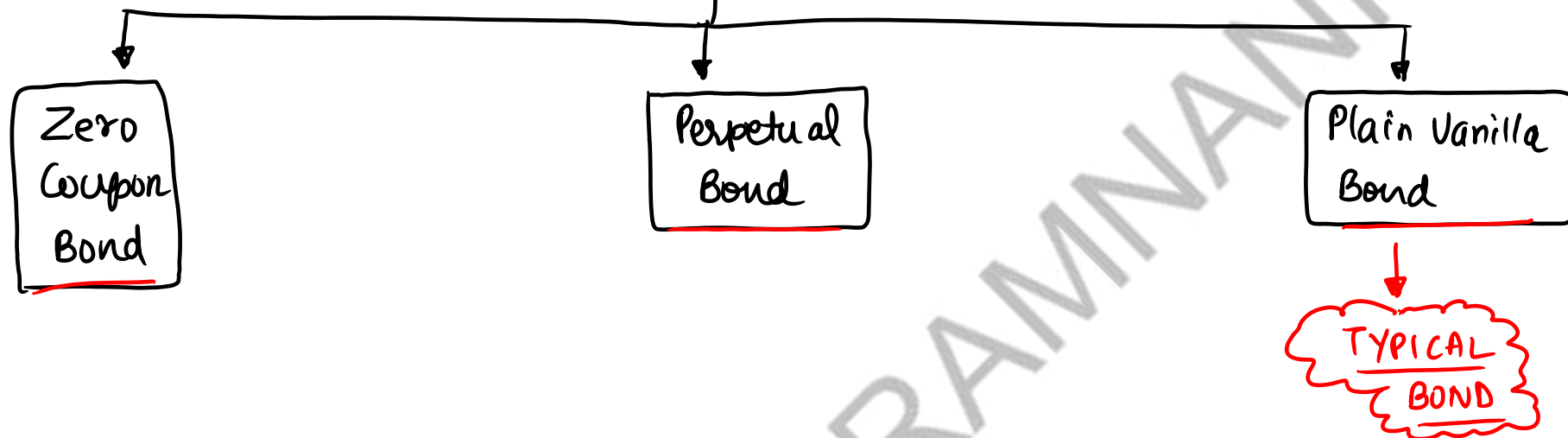


<u>Re</u> (%)	<u>YTM</u> (%)
① Going Interest Rate ② Yield on <u>similar</u> bond ③ Appropriate <u>discount rate</u>	① IRR ② Yield of <u>that</u> bond ③ Priced to Yield ④ Market Yield

Note:-
 Always make sure that Re (%) or YTM % is in line with n / coupon Period

↓
 p.a. = Year rate ← Yearly,
semi-annual rate ← semi-annually

Types of Bond

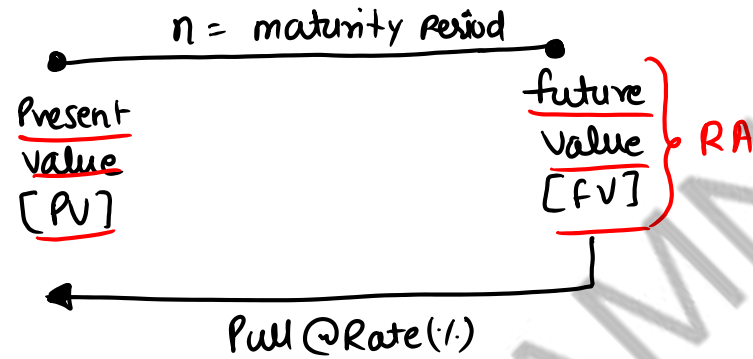


ZERO COUPON BOND

ZCB

$$n = \text{✓}$$

$$\text{coupon} = \text{✗}$$



⇓

$$PV(z) = \frac{FV(z)}{(1+r)^n}$$

Redemption Amount (RA)

CG tax ✗

$$V_0 = \frac{FV}{(1+Re)^n}$$

CG tax ✗

$$P_0 = \frac{FV}{(1+YTM)^n}$$

Note:-

If FV, P_0, n given,

then calculate YTM.

$$P_0 = \frac{FV - \text{Capital Gain tax Amount}^*}{(1 + \text{YTM})^n}$$

↑ "RA"

↓ tax ✓

* Capital Gain tax → Investor

Redemption Amount (RA)

✓ → Sale Price = 150

(-) Indexed Cost of Acquisition (ICOA) :-

$$P_0 \times [1 + \text{indexation rate}]^n$$

(✓) → 150 → (120)

Capital Gain Amount

✓

"capital appreciation"
when tax ✓

tax (%)

✓ %

[RA - Indexed P₀]

Capital Gain tax Amount

✓

$$[\text{Cap. Gain Amt.} \times \text{tax \%}]$$

Notes :-

- ① NO coupon is paid.
- ② [Macaulay's Duration = 'Duration' = $\boxed{D}$] = maturity period = $\boxed{n}$.

Question :-

Given :-

face value = Redemption Amount = Future Value (FV) = 10,000] assumed redeemed at par

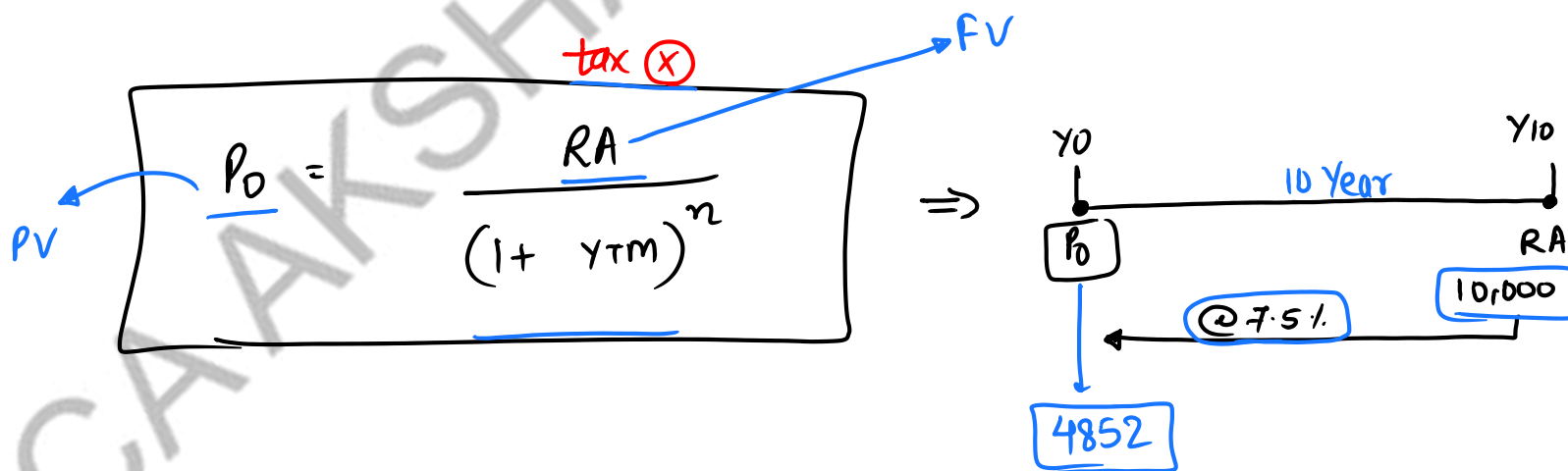
n = 31/03/13 $\rightarrow$ 31/03/23 = 10 years

coupon = (X)

Yield = YTM = 7.5 % p.a. = $\frac{7.5}{100} =$ 0.075

maturity period is in years
so YTM should be a yearly rate.

"ZCB would fetch" $\rightarrow$ P_0 = ?



$$P_0 = \frac{10,000}{(1 + 0.075)^{10}}$$

$$P_0 = \frac{\text{₹ } 10,000}{2.0610}$$

$$P_0 = \text{₹ } 4852$$

PERPETUAL BOND

$$n = (\infty)$$

$$\text{Coupon} = (\checkmark)$$



- Non-redeemable bond,
- Irredeemable bond etc.

$$PV(\text{₹}) = \frac{\text{Coupon Amount (₹)}}{\text{Rate (\%)}}$$

$$\textcircled{1} \quad \underline{V_0(\text{₹})} = \frac{\text{Coupon Amount (₹)}}{\underline{Re (\%)}} \quad \textcircled{\uparrow}$$

$$\underline{P_0(\text{₹})} = \frac{\text{Coupon Amt (₹)}}{\underline{YTM (\%)}}$$

Notes :-

① NO maturity period, i.e. $n = (X)$

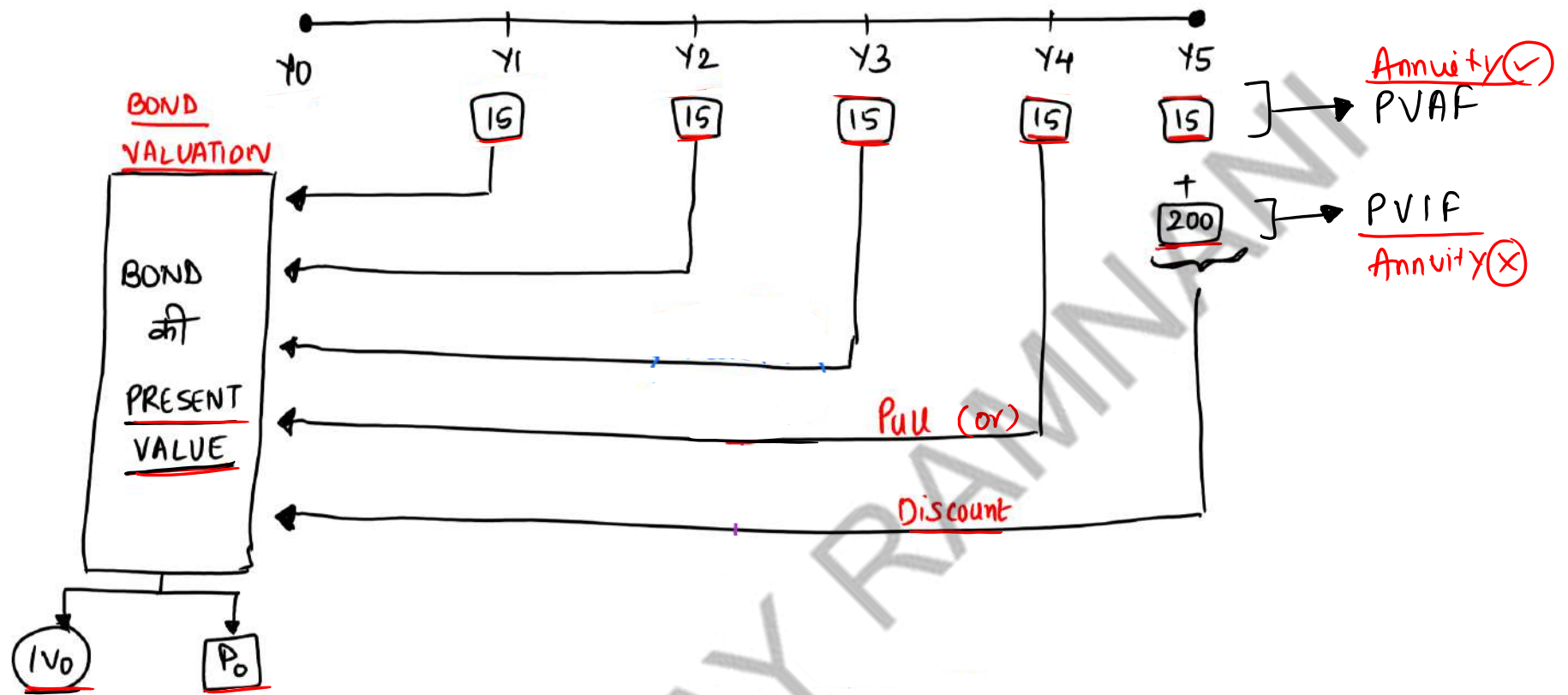
② [Macaulay's Duration = 'Duration' = D] = $\frac{1 + YTM}{YTM}$

PLAIN VANILLA BOND



$n = (✓)$

coupon = (✓)



$$\boxed{PV} = \left\{ \frac{\text{Coupon Amount}}{(\text{₹})} \times \text{PVA}F \left[\textcircled{r}, \text{Maturity Period } \textcircled{n} \right] \right\} + \left\{ \frac{\text{Redemption Amt (RA)}}{\text{₹}} \times \text{PVIF} \left[\textcircled{r}, \textcircled{n} \right] \right\}$$

$$\boxed{V_0} = \left\{ \frac{\text{coupon amt. (₹)}}{\text{₹}} \times \text{PVA}F \left[\textcircled{Re}, \textcircled{n} \right] \right\} + \left\{ RA \times \text{PVIF} \left[\textcircled{Re}, \textcircled{n} \right] \right\}$$

$$\boxed{P_0} = \left\{ \frac{\text{coupon amt. (₹)}}{\text{₹}} \times \text{PVA}F \left[\textcircled{YTM}, \textcircled{n} \right] \right\} + \left\{ RA \times \text{PVIF} \left[\textcircled{YTM}, \textcircled{n} \right] \right\}$$

Question:-

Given,

$$\text{Par Value} = \text{face Value} = \text{Redemption Amount (RA)} = \text{₹100} \quad \left[\begin{array}{l} \text{assumed redeemed} \\ \text{at par} \end{array} \right]$$

$$\text{Coupon Rate} = \underline{12\%} \quad (\text{paid semi-annually})$$

$$\text{Maturity Period} = \boxed{n} = \underline{8 \text{ years}}$$

$$\text{Required rate of return} = \boxed{Re} = \underline{14\%}$$

$$\text{value of Bond} = \boxed{V_0} = ?$$

Coupon amount

$$\text{Coupon Rate (\%)} \times \text{Face Value}$$

$$= \underline{12\%} \times \underline{\text{₹100}}$$

$$= \boxed{\text{₹12}}$$

$$\text{Periodic} = \text{₹12} = \boxed{\text{₹12}}$$

V.IMP

maturity period = $\boxed{n}$

8 years

$\boxed{Re}$ rate (%)

$\boxed{14\%}$

assume
P.A.

Coupon $\frac{14\%}{2} = 7\%$
(semi-annual)

$8 \times 2 = 16$ half years
where
2 half years = 1 Year

$\frac{14\%}{2} = 7\%$

$$V_0 = \left[\text{₹}6 \times \text{PVAF} \left(\frac{7\%, 16}{(Re, n)} \right) \right] + \left[\frac{\text{₹}100}{RA} \times \text{PVIF} \left(\frac{7\%, 16}{(Re, n)} \right) \right]$$

$$= \left[\text{₹}6 \times \left\{ \frac{1}{(1+0.07)^1} + \frac{1}{(1+0.07)^2} + \dots + \frac{1}{(1+0.07)^{16}} \right\} \right] + \left[\text{₹}100 \times \frac{1}{(1+0.07)^{16}} \right]$$

$$= \left[\text{₹}6 \times 9.447 \right] + \left[\text{₹}100 \times 0.339 \right]$$

$V_0 = \text{₹}90.58 = \text{value of bond.}$

NOTES :-

① $\gamma_{TM}(\cdot/\cdot)$ and P_0 are inversely proportional

$$\gamma_{TM}(\cdot/\cdot) \uparrow \Rightarrow P_0 \downarrow$$

and,

$R_e(\cdot/\cdot)$ and V_0 are inversely proportional,

$$R_e(\cdot/\cdot) \uparrow \Rightarrow V_0 \downarrow$$

Why?

Mathematically,

γ_{TM} f R_e are in denominator and P_0 f V_0 are final answers

$\uparrow$ $\downarrow$

② Coupon Rate (%) is ONLY used to calculate Coupon Amount.

③ If "BOND is trading at par" given in Q, it means,

→ $P_0 = \text{Face Value}$

and

$YTM (\%) = \text{coupon rate} (\%)$

④

100 BASIS POINTS = 1% , 90 Basis points = 0.90%

Yield To Maturity (YTM)

YTM TYPE 1

YTM (%)
(no tax details)
(Pre tax YTM)

The diagram illustrates the components of Return. A cloud labeled 'Return' has two arrows pointing to it: one from 'interest' and one from 'capital appreciation'. 'interest' is further broken down into 'Coupon Amt (z)'. 'capital appreciation' is broken down into $\frac{RA(z) - P_0(z)}{n}$. The word 'period' is written next to an arrow pointing from the 'Return' cloud to the right. Below these components is the formula for YTM.

$$= \left[\frac{\text{Coupon Amt (z)} + \left(\frac{RA(z) - P_0(z)}{n} \right)}{\left(\frac{RA(z) + P_0(z)}{2} \right)} \right] \times 100$$

YTM TYPE

YTM (%)

(tax details)

(Post tax YTM)

$$= \left[\frac{\text{coupon amt (₹)}^{\star 1} + \left(\frac{\text{RA (₹)}^{\star 2} - P_0 (\text{₹})}{n} \right)}{\left(\frac{\text{RA (₹)}^{\star 2} + P_0 (\text{₹})}{2} \right)} \right] \times 100$$

★1 Coupon Amount

$$\text{Coupon Amt} = \text{Coupon Amount} \left(1 - \text{income tax rate} \right)$$

★2 Redemption Amt (RA)

$$\text{RA} = \text{RA} - \text{Capital Gain tax amount}$$

↓
discussed in Zero Coupon Bond (ZCB)

CA AKSHAY RAMNANI

Question :-

Given :-

$$\text{coupon rate} = 9\%$$

$$\text{maturity} = n = 5 \text{ years}$$

$$\text{Issue Price} = \text{Purchase Price} = \text{Actual Price} = P_0 = ₹ 90 = \text{market Price}$$

$$\text{Redemption Price} = RA = ₹ 105$$

$$\text{income tax rate} = 30\% = 0.30$$

$$\text{Capital gain tax rate} = 10\%$$

$$\text{no indexation} \rightarrow \text{indexed } P_0 = P_0$$

$$\text{Assume Face Value} = ₹ 100$$

WN :-

$$\text{Coupon Amount} \times 1 = \text{coupon amt} (1 - \text{income tax rate})$$

$$= (9\% \times ₹ 100) (1 - 0.30)$$

$$= ₹ 6.30$$

$$RA^{*2} = RA - \text{cap. gain tax amount}$$

$$= RA - \left[(\underline{RA} - \text{Indexed } P_0) \times \underline{\text{C.G. tax (10\%)}} \right]$$

$$= \pounds 105 - \left[(\pounds 105 - \underline{\pounds 90}) \times \underline{10\%} \right]$$

$$= \pounds 105 - \pounds 1.50$$

$$\boxed{RA^{*2}} = \underline{\pounds 103.50}$$

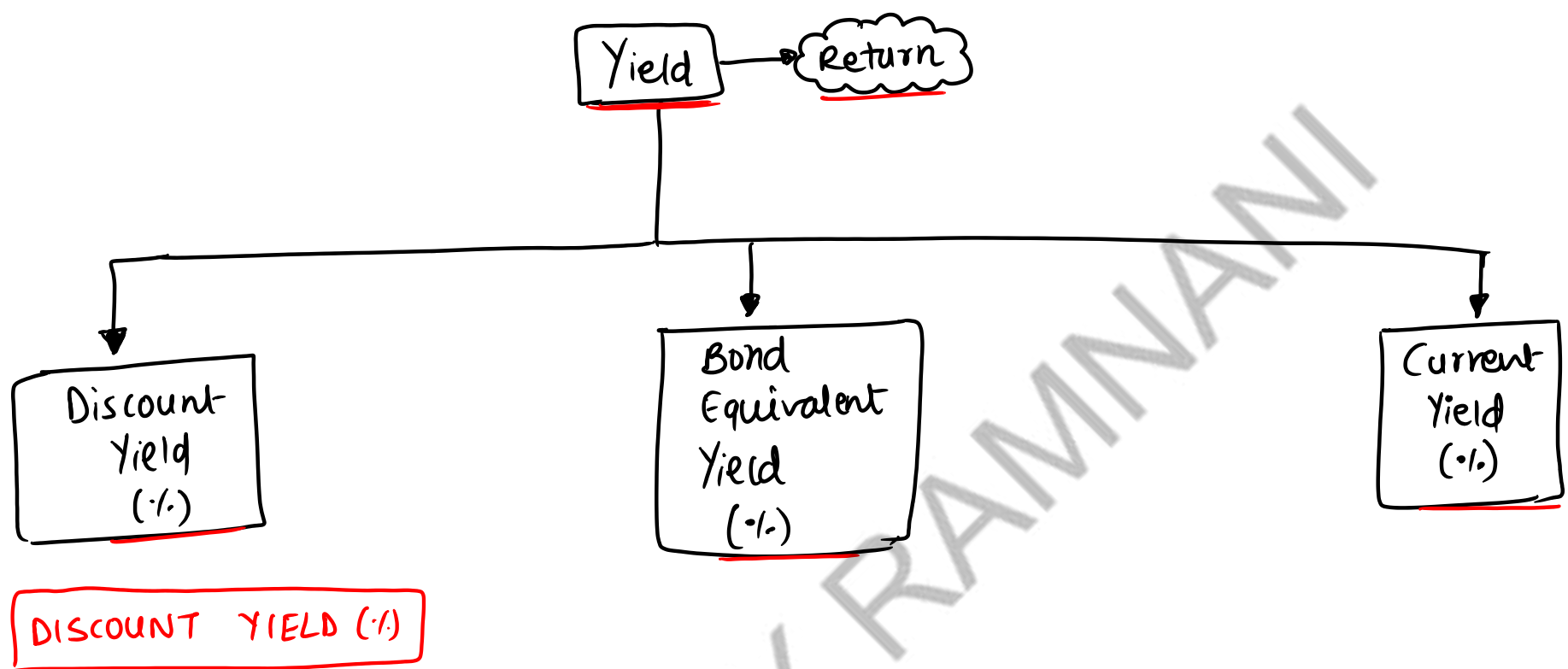
Post tax
YTM (%)

YTM TYPE 2

$$= \left[\frac{\text{Coupon Amount } \frac{n}{2} + \left(\frac{RA^{\frac{n}{2}} - P_0}{n} \right)}{\left(\frac{RA^{\frac{n}{2}} + P_0}{2} \right)} \right] \times 100$$

$$= \left[\frac{\underline{\text{₹ } 6.30} + \left(\frac{\underline{\text{₹ } 103.50} - \underline{\text{₹ } 90}}{5} \right)}{\left(\frac{\underline{\text{₹ } 103.50} + \underline{\text{₹ } 90}}{2} \right)} \right] \times 100$$

$$= \left[\frac{\text{₹ } 9.00}{\text{₹ } 96.75} \right] \times 100 \Rightarrow \boxed{9.30\%}$$



$$\text{Discount Yield (p.a.)} = \left[\left\{ \frac{\text{Face Value} - P_0}{\text{face value}} \times 100 \right\} \times \frac{12}{n} \right]$$

(n) = number of months

360 ← (✓) divide 360

365 ← (✗)

maturity period ⇒ if days given, then

$$\left(\frac{12}{n} \right) \Rightarrow \text{use } \left[\frac{365}{n} \mid \frac{360}{n} \right]$$

BOND EQUIVALENT YIELD (%) (BEY)

$$\text{Bond Equivalent Yield (\%)} = \left[\frac{\text{Face Value} - P_0}{P_0} \times 100 \right] \times \frac{12}{n}$$

(p.a.)

EQUALS TO:-

✓ ANNUALIZED YIELD

✓ MONEY MARKET YIELD (MMY)

✓ EFFECTIVE YIELD



Two conditions should be satisfied:-

- ① Redeemed at par i.e. RA = face Value
- ② NO coupon i.e. Return = capital appreciation.

(n) = number of months

if days given, then

$$\left(\frac{12}{n} \right) \Rightarrow \text{use } \left[\frac{365}{n} \mid \frac{360}{n} \right]$$

CURRENT YIELD (·%)

Current Yield $\Rightarrow$ $\left[\begin{array}{l} \text{Govt securities,} \\ \text{Govt Bonds,} \\ \text{Treasury Bonds,} \\ \text{Treasury Bills (T-Bills)} \end{array} \right]$

yield (·%)

$$\frac{\text{Full Coupon Amount (₹)}}{P_0 (\text{₹})} \times 100$$

Question:-

Given:-

"current" discount yield = 6% p.a. $\neq$ current yield
↓
अभी

maturity period = n = 45 days = [sale → purchase]

imp

"Expected" discount yield = 6% p.a. + 200 Basis points $\neq$ current yield
= 6% p.a. + $\left(\frac{200}{100}\right)\%$
= 6% + 2%
= 8% p.a.

Current Market Price = P_0

"Expected" market Price = $P_0 - ₹ 2.50$

Now, assuming 1 year = 360 days.

$$\text{discount yield} = \left[\frac{\text{Face Value} - P_0}{\text{face value}} \times 100 \right] \times \frac{360}{n}$$

"current"
discount
yield
6%.

$$= \left[\frac{\text{face value} - P_0}{\text{face value}} \times 100 \right] \times \frac{360}{45}$$

"Expected"
discount
yield
8%.

$$= \frac{\text{face value} - (P_0 - 2.50)}{\text{face value}} \times 100 \times \frac{360}{45}$$

$$6\% = \frac{\text{Face Value} - P_0}{\text{face value}} \times 100 \times \frac{360}{45}$$

$$\frac{\text{face value} - P_0}{\text{face value}} = 0.0075 \quad \checkmark$$

$\Downarrow$

$$P_0 = 0.9925 (\text{face value})$$

Using P_0 value in second equation, we get,

$$8\% = \frac{\text{face value} - \overbrace{[0.9925 (\text{face value}) - 2.50]}^{P_0}}{\text{face value}} \times 100 \times \frac{360}{45}$$

$\Downarrow$

$$0.0025 (\text{face value}) = ₹ 2.50$$

$$(8) \quad \text{face value} = ₹ 1000$$

$$(i) \text{ Face Value } = \underline{\underline{₹ 1000}}$$

$$P_0 = \underline{0.9925} \times \underline{₹ 1000} = \underline{\underline{₹ 992.50}}$$

(ii) Bond Equivalent Yield (BEY)

$$\underline{\text{Current BEY (i)}} = \frac{\underline{\text{Face Value}} - \underline{P_0}}{\underline{P_0}} \times 100 \times \frac{360}{n}$$

$$= \frac{1000 - 992.50}{992.50} \times 100 \times \frac{360}{45}$$

$$= \underline{\underline{6.05\%}}$$

$$\underline{\text{Expected BEY (i)}} = \frac{\text{₹ 1000} - \overbrace{[992.50 - 2.50]}^{990}}{\underbrace{(992.50 - 2.50)}_{990}} \times 100 \times \frac{360}{45}$$

=

8.08%

PRICE

→ DECISION TABLE

→ No. (3)

"should be"

Price

Actual

Price



① $V_0 > P_0$

Observation

underpriced/
undervalued

Decision/Action

BUY

② $V_0 < P_0$

overpriced/
overvalued

SELL

③ $V_0 = P_0$

no mispricing/
correctly valued

Buy/HOLD

Question:-

Given

AA Rated Bond = AAA + 2% spread

364 day T Bill Rate + 3% spread

$$= \underline{9\%} + \underline{3\%} + \underline{2\%}$$

Re = 14% p.a.

face value = £1000

P_0 = £1025.86

maturity = n = 5 years

Coupon rate = 15 % p.a.

Redeemable at par $\longrightarrow$ RA = face Value = ₹1000

IV_0 = ? , Invest = BUY? , current Yield = ? , YTM = ?

Coupon amount = $15\% \times ₹1000 = ₹150$

$$\begin{aligned}\underline{IV_0} &= \text{Coupon} \times \text{PVAF}[\underline{Re}, n] + \text{RA} \times \text{PVIF}[\underline{Re}, n] \\ &= ₹150 \times \text{PVAF}[14\%, 5] + ₹1000 \times \underline{\text{PVIF}}[14\%, 5]\end{aligned}$$

$$(i) \underline{IV_0} = \underline{\underline{₹1034.32}} \quad (\underline{\underline{\text{approx}}})$$

(ii) Decision $\ominus$

undisputed

$$\left. \begin{array}{ccc} 1V_0 & > & P_0 \\ \downarrow & & \downarrow \\ \underline{1034.32} & > & \underline{1025.86} \end{array} \right\}$$

BUY $\Rightarrow$ invest (✓)

(iii)

$$\text{Current Yield} = \frac{\text{full coupon}}{P_0} \times 100$$

$$= \frac{\underline{150}}{\underline{1025.86}} \times 100 = \boxed{14.62\%}$$

(iv)

(TYPE 1)

$$YTM = \left[\frac{\text{coupon} + \left(\frac{RA - P_0}{n} \right)}{\left(\frac{RA + P_0}{2} \right)} \right] \times 100$$

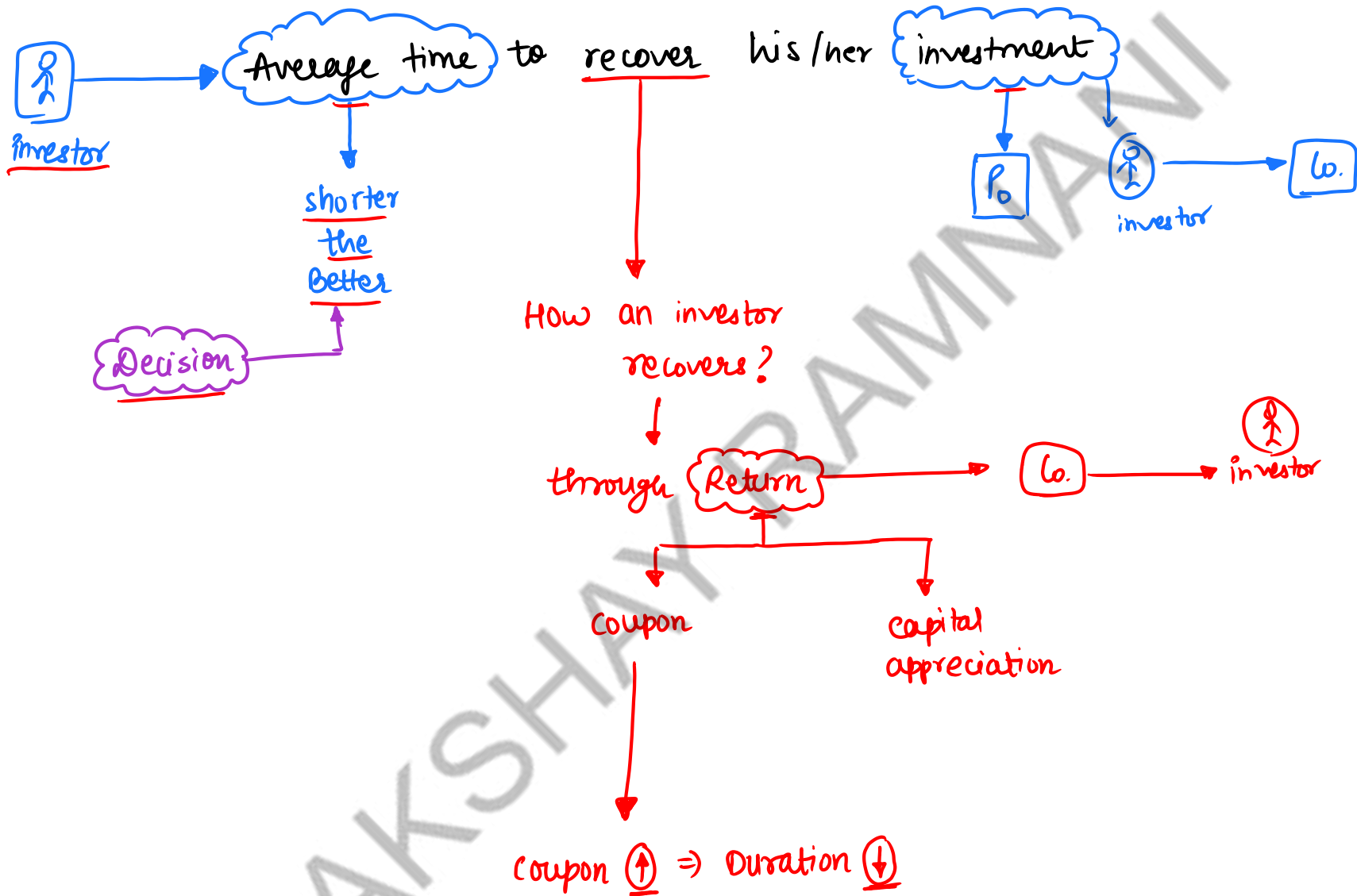
$$\left(\frac{1000 - 1025.86}{2} \right)$$

$$\boxed{\text{YTM}} = \left[\frac{\underline{150} + \left(\frac{\quad}{5} \right)}{\left(\frac{1000 + 1025.86}{2} \right)} \right] \times 100 = \boxed{14.29\%}$$

(approx)

CA AKSHAY RAMNANI

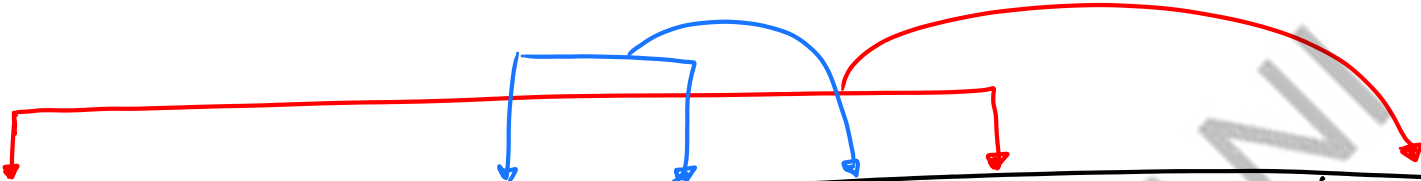
DURATION OF BOND



Note

Duration also called Macaulay's Duration or D

Calculation of Duration :-

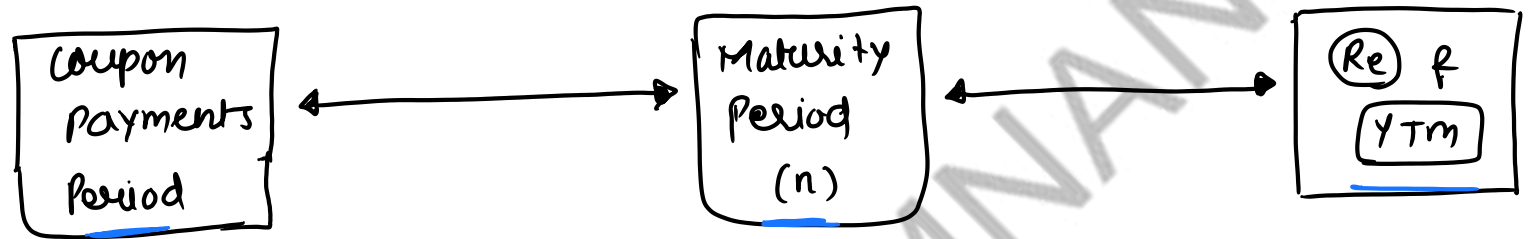


<u>Period</u> <u>(x)</u>	<u>Cash flow [CF]</u>	<u>PV</u> <u>factor</u>	<u>P.V. of C-f. @ YTM(%)</u> <u>(w)</u>	<u>wX</u>
✓	<u>Coupon</u>	$\frac{1}{(1+YTM)^1}$	✓	✓
✓	<u>Coupon</u>		✓	✓
✓	<u>Coupon</u>		✓	✓
✓	<u>Coupon + RA</u>		✓	✓
$\Sigma w = \text{✓}$				$\Sigma wX = \text{✓}$

$$\text{Duration (D)} = \frac{\Sigma wX}{\Sigma w}$$

→ This is P_0

Note:- Always make sure that, following are in line:-



Question:-

Given:-

coupon = 14% (paid semi-annually)

Face value = ₹100

P_0 = ₹90

RA = face value = ₹100

maturity(n) = 5 years

coupon amount

$$14\% \times \underline{₹100} = \underline{₹14}$$

$$\frac{₹14}{2} = \boxed{₹7}$$

maturity (n)

5 years

$$5 \times 2 = \boxed{10} \text{ half years}$$

YTM/Re

half yearly
✓

(i) Current Yield

? imp

$$= \frac{\text{Full Coupon}}{\text{}} \times 100 = \underline{₹14} \times 100 = \boxed{15.55\%}$$

P_0 $\text{₹ } 90$

(9) YTM

$$= \left[\frac{\text{coupon} + \left(\frac{RA - P_0}{n} \right)}{\left(\frac{RA + P_0}{2} \right)} \right] = \left[\frac{\underline{7} + \left(\frac{100 - 90}{10} \right)}{\left(\frac{100 + 90}{2} \right)} \right] = \boxed{8.42\%} \text{ (approx)}$$

(11) Duration

Table :-

<u>Period</u> <u>(HALF YEARS)</u>	Cash Flow (CF)	PV Factor of YTM = 8.42%	PV of CF @ 8.42%	<u>WX</u>
<u>2</u> <u>X</u>		$\frac{1}{(1+0.0842)^1}$	<u>W</u>	
1	7	0.922	6.45	6.45
2	7	0.851	5.96	11.91
3	7	0.785	5.50	16.49
4	7	0.724	5.07	20.27
5	7	0.668	4.68	23.38
6	7	0.616	4.31	25.87
7	7	0.568	3.98	27.83
8	7	0.524	3.67	29.34
9	7	0.483	3.38	30.43
<u>10</u>	<u>107</u>	0.445	47.02	470.15
			$\Sigma =$ 90.00	$\Sigma =$ 662.13

RA + C
(100 + 7)

(approx) P₀

$$\text{Duration} = \frac{\sum wx}{\sum w} = \frac{662.13}{90} = 7.357 \quad \boxed{\text{half years}}$$

imp

$$\text{Duration (years)} = \frac{7.357}{2} = \boxed{3.6785} \text{ years.}$$

(iff) intermediate coupons are not available for reinvestment

coupon (X)

if paid coupon,
investor will use this
return as investment

Plain Vanilla Bond

will become

Zero Coupon Bond

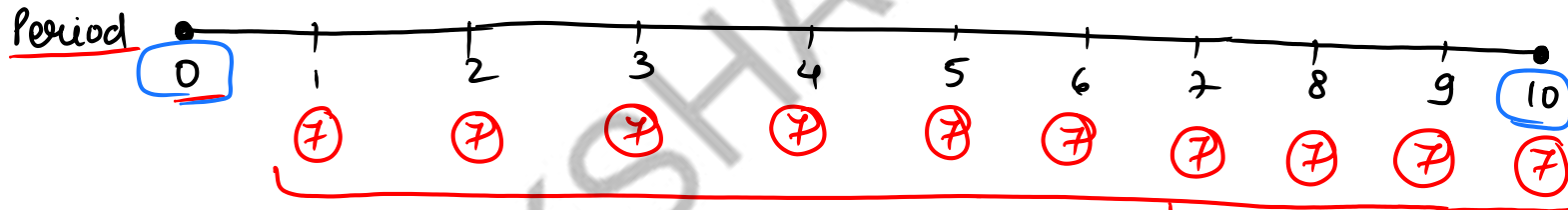
ZCB

coupon (✓)

n (✓)

coupon (X)

n (✓)



7×10

= 70

= 100

170

future value

Present Value (PV)

P_0

"Realised Yield"

ZCB or YTM(-)

90

$$\underline{P_0} = \frac{RA + \text{Coupon Amount}}{(1 + YTM)^n}$$

$$90 = \frac{100 + 70}{(1 + YTM)^{10}}$$

$$YTM = \left(\frac{170}{90} \right)^{\frac{1}{10}} - 1$$

→ Dirty Power

$$= 0.06567 \text{ (or)}$$

$YTM = 6.567\%$

↓
(approx)

→ [half yearly / semi annually]

$$\text{YTM}(\%) \text{ p.a.} = 6.567 \times \underline{2} = \boxed{13.134\%}$$

(approx)

CA AKSHAY RAMNANI

MODIFIED DURATION OF BOND

↓
"Volatility" of Bond

↓
formula (1)

$$\text{Modified Duration} = \frac{\text{Duration (D)}}{1 + YTM}$$

↓
formula (2)

$$\text{modified duration} = \frac{\% \text{ change in Price (P}_0\text{)}}{\% \text{ change in } \underline{YTM}}$$

Note :-

① In formula (2), take absolute change.

Eg: if % change = 80 Basis points

use $\% \text{ change} = 0.80\%$ $\rightarrow$ ie 0.80 numeric value in formula.

$$\frac{0.80}{100} = 0.0080 \rightarrow$$

② YTM and P_0 are inversely proportional.

$$\text{YTM} \uparrow \rightarrow P_0 \downarrow$$

Question:-

(i) Current Market Price = P_0 = $\boxed{\text{₹ } 834.48}$

(ii) Duration of Bond = D = $\boxed{4.570}$ years

(iii) Volatility of Bond :-

$$\text{Volatility} = \text{Modified Duration} = \left[\frac{D}{1 + YTM} \right]$$

$$= \frac{4.570}{1 + 0.15}$$

$$= \frac{4.570}{1.15}$$

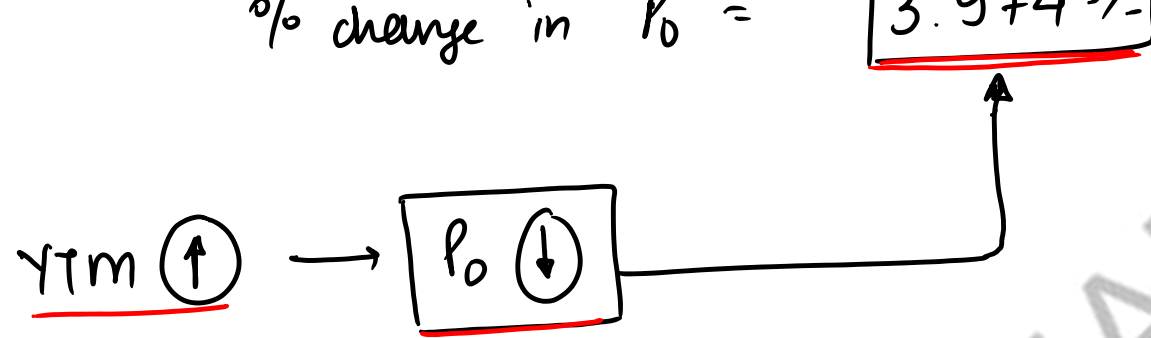
3.974

(iv) Expected P_0 :

100 Basis points = 1%

$$\text{Volatility} = \frac{\% \text{ change in } P_0}{\% \text{ change in YTM}}$$

3.974 =
$$\frac{\% \text{ change in } P_0}{1\%}$$



$$\begin{aligned}\text{Expected } P_0 &= P_0 - [3.974\% \times P_0] \\ &= ₹ 834.48 - [3.974\% \times 834.48] \\ &= \boxed{₹ 801.318}\end{aligned}$$

(v) Expected P_0

75 Basis Points = $\boxed{0.75\%}$

3.974 = % change in P_0

$$\underline{3.974 =}$$

$$\frac{\% \text{ change in } P_0}{\underline{0.75 \%}}$$

$$\% \text{ change in } P_0 = \underline{2.9805 \%}$$

YTM (↓)

⇒

P_0 (↑)

$$\text{Expected } P_0 = \underline{P_0} \oplus [\underline{2.9805 \%} \times \underline{P_0}]$$

$$= \text{₹} 834.48 + [2.9805 \% \times 834.48]$$

$$= \underline{\underline{\text{₹} 859.35}}$$

CA AKSHAY RAMNANI

Question:- (Part A)

Given,

	<u>Bond ①</u>	<u>Bond ②</u>
Maturity (<u>n</u>)	<u>5 years</u>	<u>20 years</u>
Face Value	<u>₹ 1000</u>	<u>₹ 1000</u>
Coupon (%)	<u>8% p.a.</u>	<u>8% p.a.</u>
P_0 = <u>face Value</u>	<u>₹ 1000</u>	<u>₹ 1000</u>
YTM = <u>coupon (%)</u>	<u>8% p.a.</u>	<u>8% p.a.</u>
<u>new YTM</u>	<u>6% p.a.</u>	<u>6% p.a.</u>
<u>new P_0</u>	<u>?</u>	<u>?</u>

Bond ①

$$\boxed{\text{new } P_0} = \text{coupon} \times PVAF [\text{new YTM}, n] + \underline{RA} \times PVIF [\text{new YTM}, n]$$

$$= (8\% \times 1000) \times PVAF [6\%, 5] + 1000 \times PVIF [6\%, 5]$$

$$= \boxed{\text{₹ } 336.96} + \boxed{\text{₹ } 747}$$

$\uparrow$ PV of Coupon
 "PV of interest payments"
 $\uparrow$ PV of RA
 $\downarrow$ Principal Amount = Face Value.
 ↪ Because assumed redeemed at par

$$= \boxed{\text{₹ } 1083.96}$$

Bond ②

$$\boxed{\text{new } P_0} = \text{₹ } 80 \times \text{PVAF} [6\%, 20] + 1000 \times \text{PVIF} [6\%, 20]$$

$$= \boxed{\text{₹ } 917.60} + \boxed{\text{₹ } 312}$$

$$= \boxed{\text{₹ } 1229.60}$$

Now, let us calculate PV of Coupon and PV of RA in original case.

Bond ①

$$P_0 = \underline{80} \times \text{PVAF} [\underline{8\%}, \underline{5}] + \underline{1000} \times \text{PVIF} [\underline{8\%}, \underline{5}]$$

$$\downarrow$$
$$\underline{1000} = \underline{319.41} + \underline{680.59}$$

Bond ②

$$P_0 = 80 \times \text{PVAF} [8\%, 20] + 1000 \times \text{PVIF} [8\%, 20]$$

$$\downarrow$$
$$\underline{1000} = \underline{785.45} + \underline{214.55}$$

Now, comparing the two, we get,

BOND ①

	<u>YTM</u>	<u>P₀</u>	<u>PV of Coupon Amounts</u>	<u>PV of RA = Principal</u>
	<u>8%</u>	<u>1000</u>	<u>319.41</u>	<u>680.59</u>
	<u>6%</u>	<u>1083.96</u>	<u>336.96</u>	<u>747</u>
Difference	<u>-2%</u>	<u>+ 83.96</u>	<u>+17.55</u>	<u>+66.41</u>
Percentage		<u>100%</u>	<u>20.90%</u>	<u>79.10%</u>

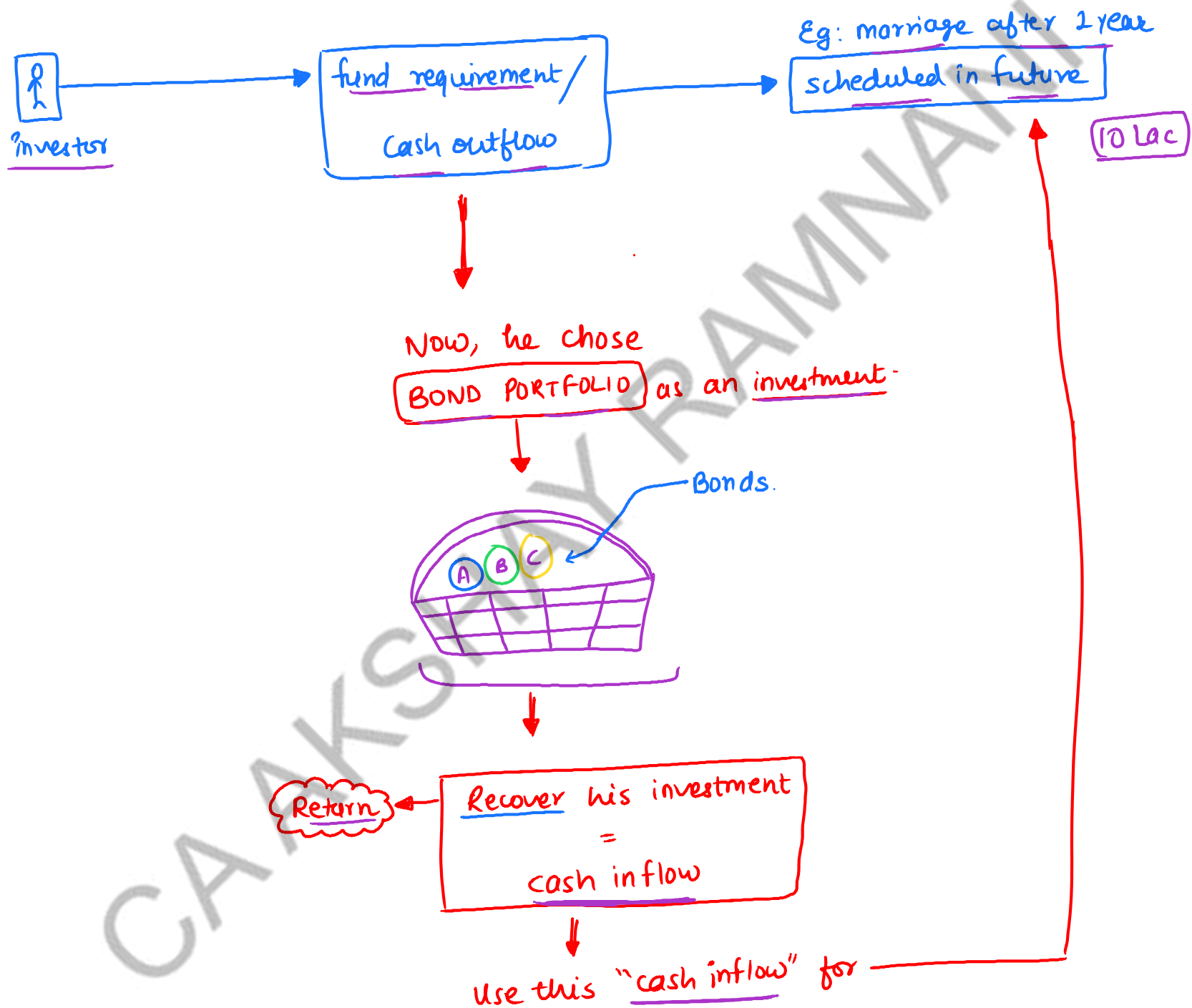
$$\left[\begin{array}{l} \underline{83.96} \rightarrow \underline{100\%} \\ \underline{17.55} \rightarrow \frac{100}{83.96} \times 17.55 \end{array} \right]$$

BOND ②

	<u>YTM</u>	<u>P₀</u>	<u>PV of Coupon Amounts</u>	<u>PV of RA = Principal</u>
	8%	1000	<u>785.45</u>	<u>214.55</u>
↓	6%	1229.60	<u>917.60</u>	<u>312</u>
Difference	<u>-2%</u>	<u>+229.60</u>	<u>+132.15</u>	<u>+97.45</u>
Percentage		100%	57.55%	42.45%

$$\begin{array}{l}
 229.60 \rightarrow 100\% \\
 132.15 \rightarrow \frac{100}{229.60} \times 132.15
 \end{array}$$

IMMUNISATION



In order to do this, it is important that,

$$\text{Cash inflow time} = \text{Cash outflow time}$$

$$\text{Recovery of Investment time} = \text{Cash outflow time}$$

$$\text{Bond Portfolio's Duration} = \text{Cash outflow time}$$

$$(w_A)(D_A) + (w_B)(D_B) + (w_C)(D_C) = \text{Cash outflow time.}$$

$$\text{Amount of investment done in Bond A, B, C} = \text{P.V. of Total Amt. required in future.}$$

Note:-

When above equation holds true, then it is said that

① When _____

Bond Portfolio is immunised.

② Immunisation process immunes/safeguards the Bond Portfolio from

Price Risk and Reinvestment Rate Risk

↓
Risk that P_0
of Bonds decreases
So you cannot book
good profit before
maturity.

↓
Risk that the return → coupon
are invested at lower YTM. → cap. appreciation

Question:-

imp

current yield = YTM (∵) = 9% for Bond (A), (B), (C).

face Value = ₹100

Redeemed at par $\Rightarrow$ RA = face Value = ₹100

Cash outflow time = 6 years

(i) Duration

Bond (A) = 6.862 years = DA

Bond (B) = 5.833 years = DB

Bond (C) = 4.242 years = DC

(ii)

weight of Bond (A) = WA = 45% = 0.45

Now,

Total of weights of all Bonds in a Portfolio = 1

$$\underline{w_A} + \underline{w_B} + \underline{w_C} = \underline{1}$$

$$\boxed{0.45} + w_B + w_C = 1$$

$$\boxed{w_B + w_C = 0.55}$$

$$\boxed{w_C = 0.55 - w_B}$$

NOW,

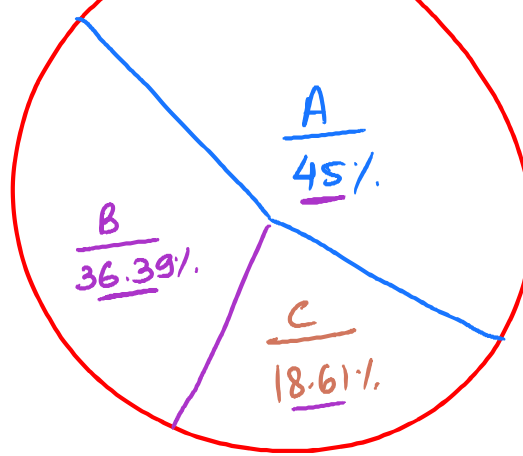
To immunise the portfolio, following equation shall hold true :-

$$\checkmark (\underline{w_A}) (\underline{D_A}) + (\underline{w_B}) (\underline{D_B}) + (\underline{w_C}) (\underline{D_C}) = \boxed{\text{cash outflow}} \underline{\text{time}}$$

$$\rightarrow \underline{0.45} (\underline{6.862}) + (\underline{w_B}) (\underline{5.833}) + (\underline{0.55 - w_B}) (\underline{4.242}) = \underline{6 \text{ years}}$$

$$w_B = \underline{0.3639} \text{ or } \boxed{36.39\%}$$

$$\underline{w_C} = 0.55 - 0.3639 = 0.1861 \text{ or } \boxed{18.61\%}$$



BOND PORTFOLIO

immunised.

(iii) Let us check the equation,

$$\underline{0.45}(\underline{7.15}) + \underline{0.3639}(\underline{6.03}) + \underline{0.1861}(\underline{4.27})$$

$$\boxed{6.20} \text{ years} \neq \boxed{6} \text{ years}$$

Not immunised.

(9v)

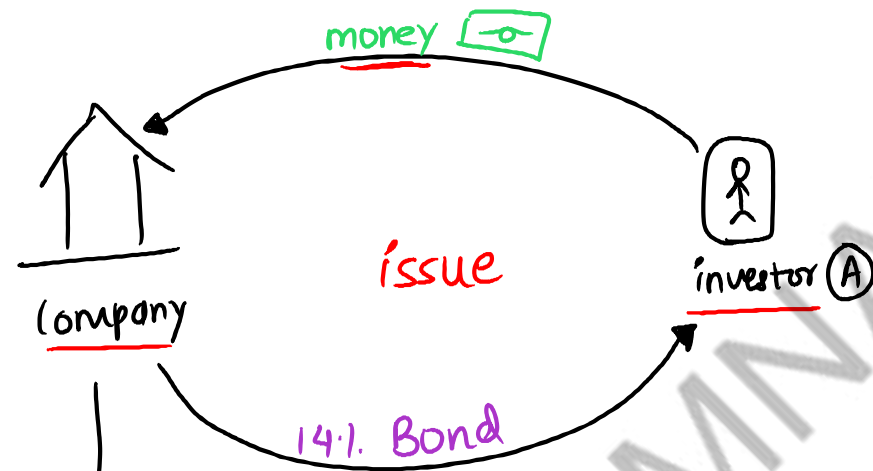
$$0.45(7.15) + w_B(6.03) + [(0.55 - w_B)(4.27)] = 6$$

$$w_B = 0.2466 = 24.66\% \quad \checkmark$$

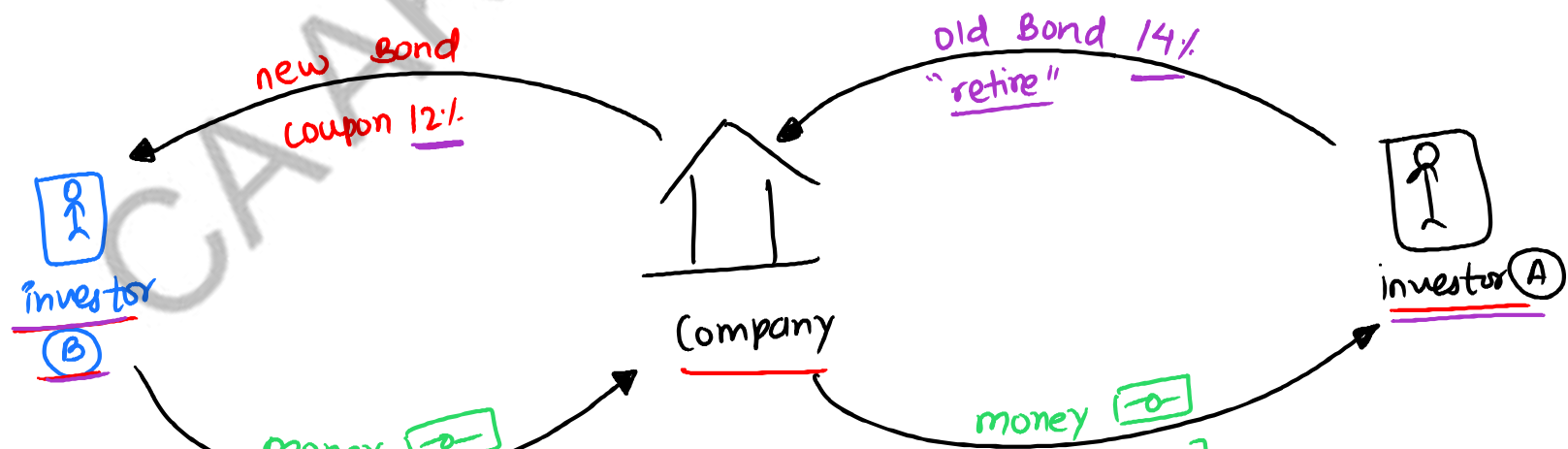
$$w_C = 30.34\% \quad \checkmark$$

CA AKSHAY RAMNANI

BOND REFUNDING



Now, interest rates in the market are falling.
Company wants to save interest expense (coupon)



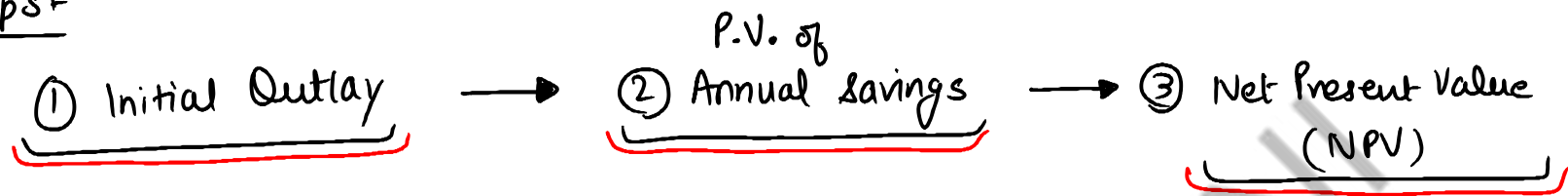
money (inflow)

[outflow]

Note :-

- ① Just like we have concept of "BUYBACK OF SHARES", this is a concept in Bond Valuation, which is called "BOND REFUNDING"
- ② follow the following steps to decide whether Bond Refunding should be done or not (company point of view)

Steps:



① Initial Outlay

Old Bond Value

(+) call premium @ (%) $\Rightarrow$ one time exp. in books

(outflow) A $\rightarrow$

New Bond value

(-) Issue cost of new Bond $\Rightarrow$ deferred exp in books

(inflow) B $\rightarrow$

[amortised over a period]

initial floatation cost +
Discount on issue of Bond

$\rightarrow$ Tax saving on Old Bond (one last time) :-

$$\left[\begin{array}{c} \text{Unamortised} \\ \text{issue} \\ \text{cost of} \\ \text{old Bond} \end{array} + \begin{array}{c} \text{Call} \\ \text{Premium} \\ \text{old Bond} \end{array} \right] \times \text{tax (\%)} = \checkmark \rightarrow \text{C (inflow)}$$

→ Overlapping Interest (extra cost)

$$\left[\begin{array}{c} \text{old Bond} \\ \text{face} \\ \text{value} \end{array} \times \begin{array}{c} \text{old Bond} \\ \text{coupon \%} \\ \text{rate} \\ \text{(P.A.)} \end{array} \right] \times \frac{\text{No. of months overlap}}{12 \text{ months}} \times (1 - \text{tax \%}) = \checkmark \rightarrow \text{D (outflow)}$$

$$\text{① Initial Outlay} = \underbrace{\text{A} + \text{D}}_{\text{outflow}} - \underbrace{\text{B} - \text{C}}_{\text{inflow}} = \checkmark$$

② PV of Annual Savings

→ Annual Interest Savings

$$\left[\frac{\text{Old Bond Value}}{\text{value}} \times \left\{ \frac{\text{old bond coupon} (\cdot i)}{\text{coupon} (\cdot i)} - \frac{\text{new Bond coupon} (\cdot i)}{\text{coupon} (\cdot i)} \right\} \right]$$



→ Tax Savings no more

$$\left[\begin{array}{c} \text{Annual Interest Savings} \\ \checkmark \end{array} \times \text{tax} (\cdot i) \right] + \left[\frac{\left(\frac{\text{unamortised issue cost on Old Bond}}{\text{issue cost on new Bond}} \right)}{\text{Remaining No. of Years}} \times \text{tax} (\cdot i) \right] (\checkmark)$$

ANNUAL SAVINGS



③ Net Present Value (NPV)

NPV =

Present Value of Annual Savings

—

Initial Outlay

$$\frac{\text{Annual Savings}}{\text{Savings}} \times \text{PVAF} \left(\frac{\text{Post-tax } K_d}{K_d}, \frac{\text{remaining years}}{\text{years}} \right)$$

if not given, use

$$\frac{\text{new Bond coupon rate}}{\text{coupon rate}} (1 - \text{tax \%})$$

Decision :-

$$\text{NPV} = +ve$$

Bond Refunding should be done.

$$\text{NPV} = -ve$$

Bond Refunding should not be done.

Question :-

Given,

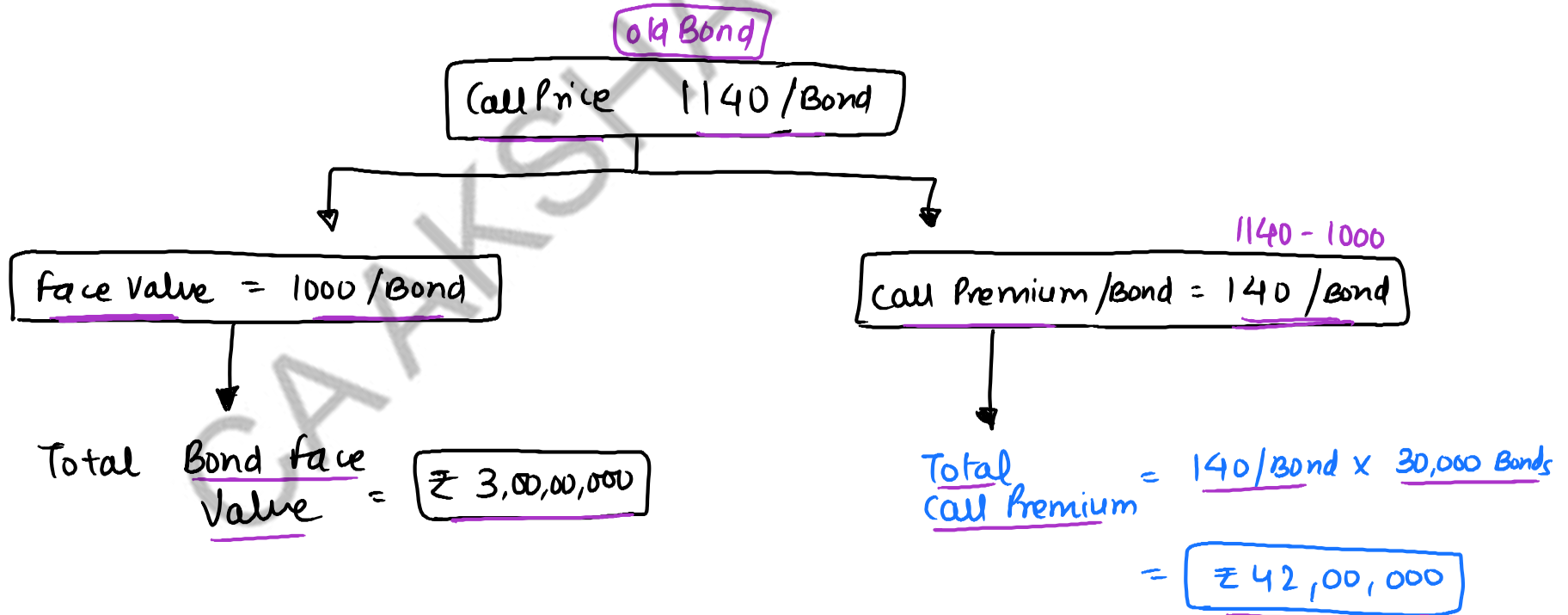
old Bond call price = ₹ 1140 / Bond

face value = ₹ 1000 / Bond

Total face value = ₹ 3,00,00,000

Nb. of Bonds =
$$\frac{\text{Total face value}}{\text{face value/Bond}} = \frac{₹ 3,00,00,000}{₹ 1000/\text{Bond}}$$

= 30,000 Bonds



Initial floatation cost of old Bond = ₹ 360,000

Discount on issue.

$$[\text{₹ } 30/\text{Bond} \times 30,000 \text{ Bonds}] = \text{₹ } 900,000$$

Total Issue cost of old Bond. ₹ 12,60,000

Amortise upto maturity i.e.

30 years

Today, i.e. after 5 years

5 years

Amortised
issue cost = $\frac{1260,000 \times 5}{30} = \text{₹ } 210,000$

Remaining Years
25 Years

unamortised issue cost of
old Bond.

$12,60,000 \times \frac{25}{30}$

$$\frac{1200000 \times 25}{30}$$

$$= \boxed{10,50,000}$$

CA AKSHAY RAMNANI

① Initial Outlay

→ old Bond Value

₹ 3,00,00,000

(+) Call Premium

₹ 42,00,000 ← one time exp in books

Ⓐ →

₹ 3,42,00,000

→ new Bond Value

₹ 3,00,00,000

(-) issue cost on new Bond

(400,000) ← deferred exp in books

Ⓑ →

₹ 2,96,00,000

→ Tax saving on old bond (one last time)

$$\left[\underline{10,50,000} + \underline{42,00,000} \right] \times \underline{0.40} = ₹ 21,00,000 \leftarrow \text{Ⓒ}$$

→ overlapping Interest (extra cost)

$$\left[\underbrace{(3,00,00,000 \times 14\%)}_{\text{old bond}} \times \frac{2}{12} \right] \underbrace{(1 - 0.40)} = ₹ 420,000 \leftarrow \textcircled{D}$$

$$\text{Initial Outlay} = [\textcircled{A} + \textcircled{D}] - \textcircled{B} - \textcircled{C}$$

$$= 3,42,00,000 + 420,000 - 2,96,00,000 - 21,00,000$$

$$= \boxed{₹ 29,20,000}$$

② P.V. of Annual Savings

→ Annual Intt. Savings

$$\left[₹ 200,00,000 \times (14\% - 12\%) \right] ₹ 600,000$$

$$\left[\underline{250,00,000} \times (\underline{14\% - 12\%}) \right]$$

→ Tax Savings no more

$$\left[\underline{600,000} \times \underline{0.40} \right] (+)$$

$$\left[\left\{ \frac{\underline{10,50,000} - \underline{400,000}}{\underline{25}} \right\} \times \underline{0.40} \right] \quad (\underline{₹ 250,400})$$

Annual Savings

₹ 349,600

Post tax cost of debt (K_d)

8%

P.V. of Annual Savings

$$\underline{₹ 349600} \times \underline{PVAF} (\underline{8\%}, \underline{25})$$

$$= \boxed{\underline{₹ 37,31,980}}$$

③ NPV

$$\underbrace{[\text{PV of Annual Savings}]} - \underbrace{[\text{initial outlay}]}$$

$$= 37,31,980 - \underbrace{29,20,000}$$

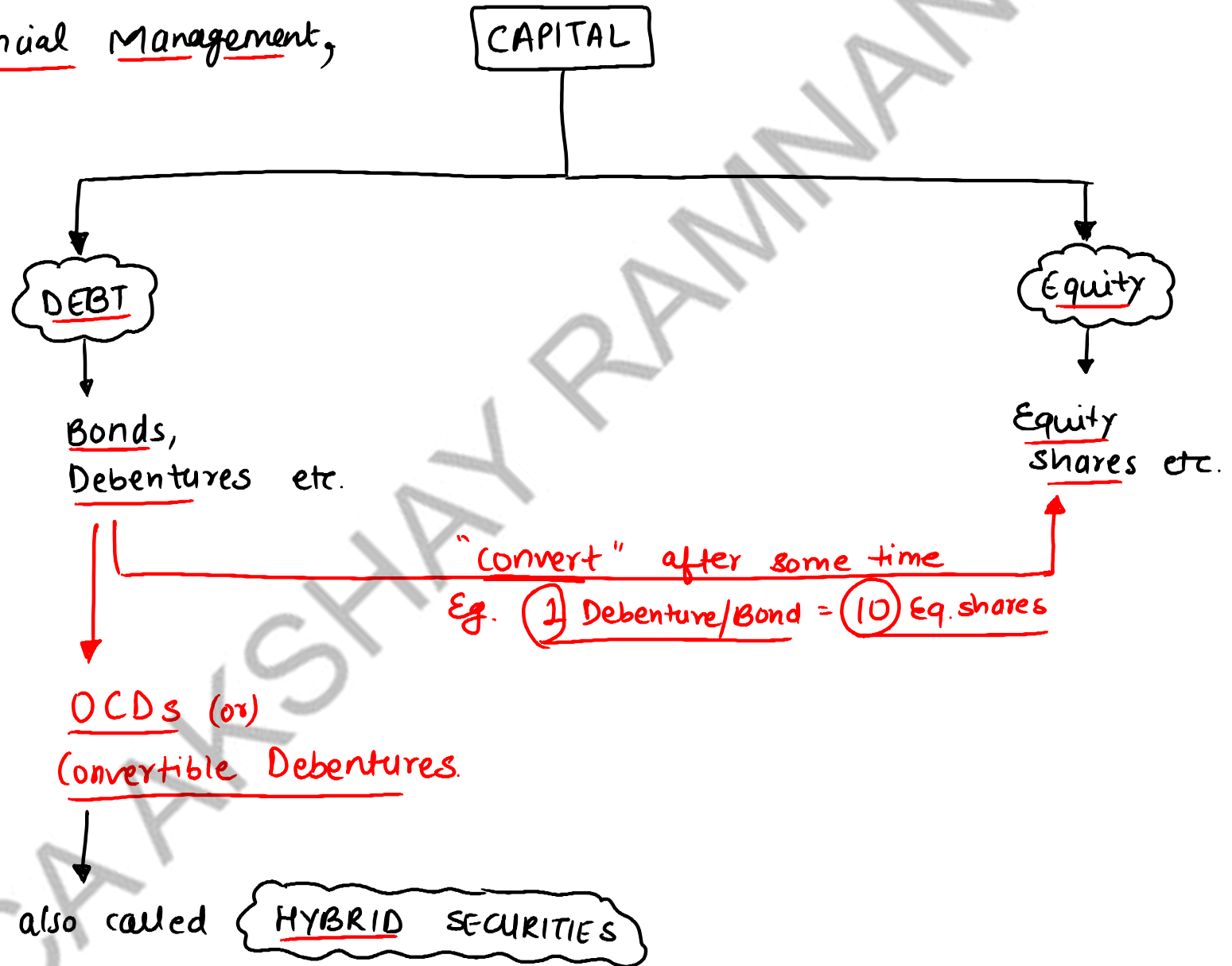
$$= \boxed{+ 8,11,980}$$



Since, NPV is positive, bond refunding is feasible

OPTIONALLY CONVERTIBLE DEBENTURES [OCD]

In financial Management,



Note:-

Here, Units are very important and helpful in solving questions.

CA AKSHAY RAMNANI

CALCULATIONS :-

① IV_0 = STRAIGHT DEBT VALUE
or
INVESTMENT VALUE

$$= \left[\text{coupon amt} \times PVAf(r, n) \right] + \left[\text{Redemption amt} \times PVIF(r, n) \right]$$

↓

$\text{₹/Bond} \Rightarrow \text{say } ₹100 \rightarrow \text{₹100/Bond}$

$Re \rightarrow$ yield on similar NON-convertible bonds

② STOCK VALUE
or
CONVERSION VALUE

$$= \left[\text{Conversion Ratio} \right] \times \left[\text{Share Price} \right]$$

$\left[\text{Equity share/Bond} \right] \quad \left[\text{₹/Eq share} \right]$

↓

₹/Bond

③ MARKET PRICE OF CONVERTIBLE BOND → OCD VALUE

usually given in Q.

₹/bond

$$\textcircled{4} \text{ CONVERSION PARITY PRICE} = \text{MARKET CONVERSION PRICE} = \left[\frac{\text{OCD VALUE}}{\text{conversion ratio}} \right]$$

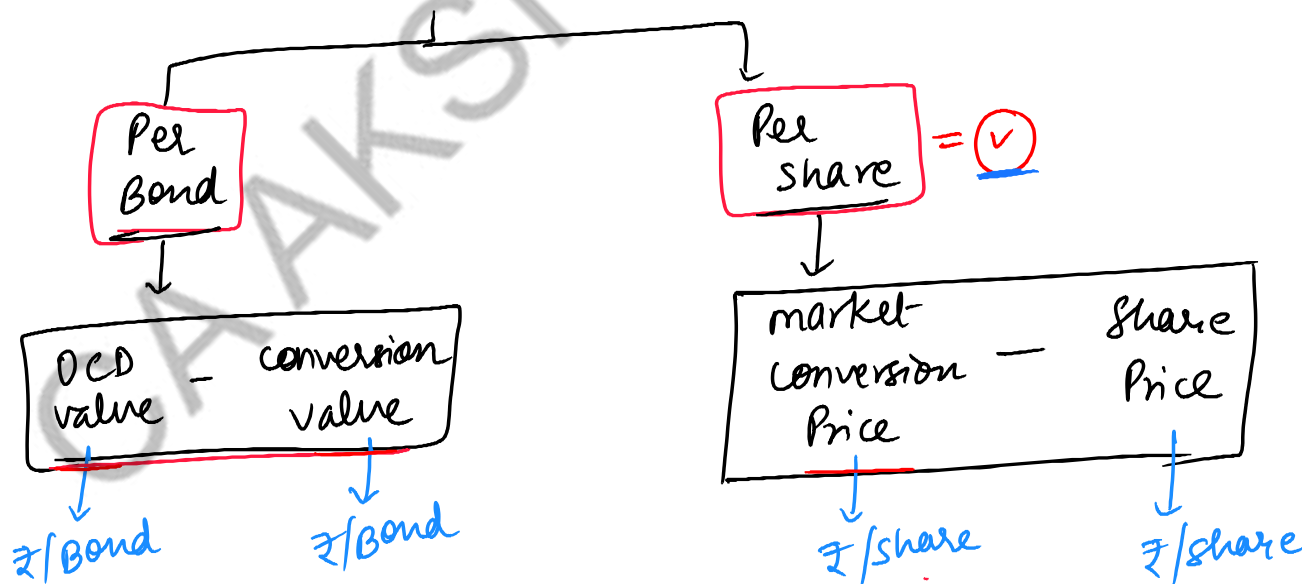
$$\frac{\text{₹}}{\text{Bond}} \div \frac{\text{Eq share}}{\text{Bond}}$$

$$\frac{\text{₹}}{\text{Bond}} \times \frac{\text{Bond}}{\text{Eq share}} \Rightarrow$$

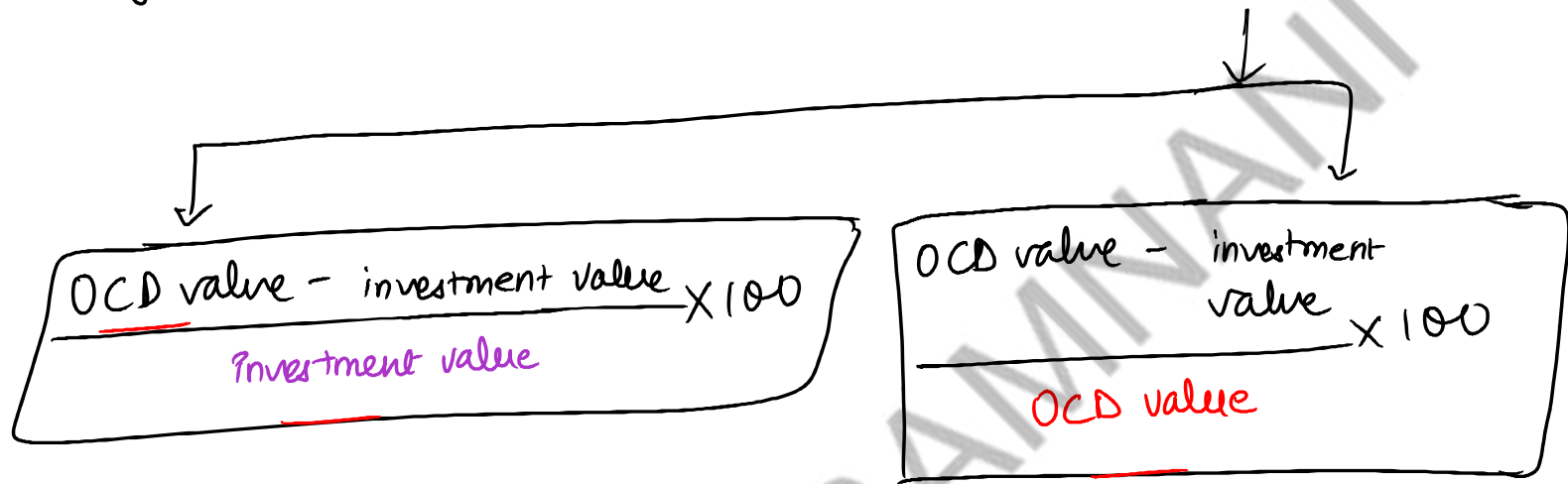
$$\left[\frac{\cancel{\text{₹/Bond}}}{\text{Eq. share}/\cancel{\text{Bond}}} \right]$$

$$\boxed{\text{₹/Eq. share}}$$

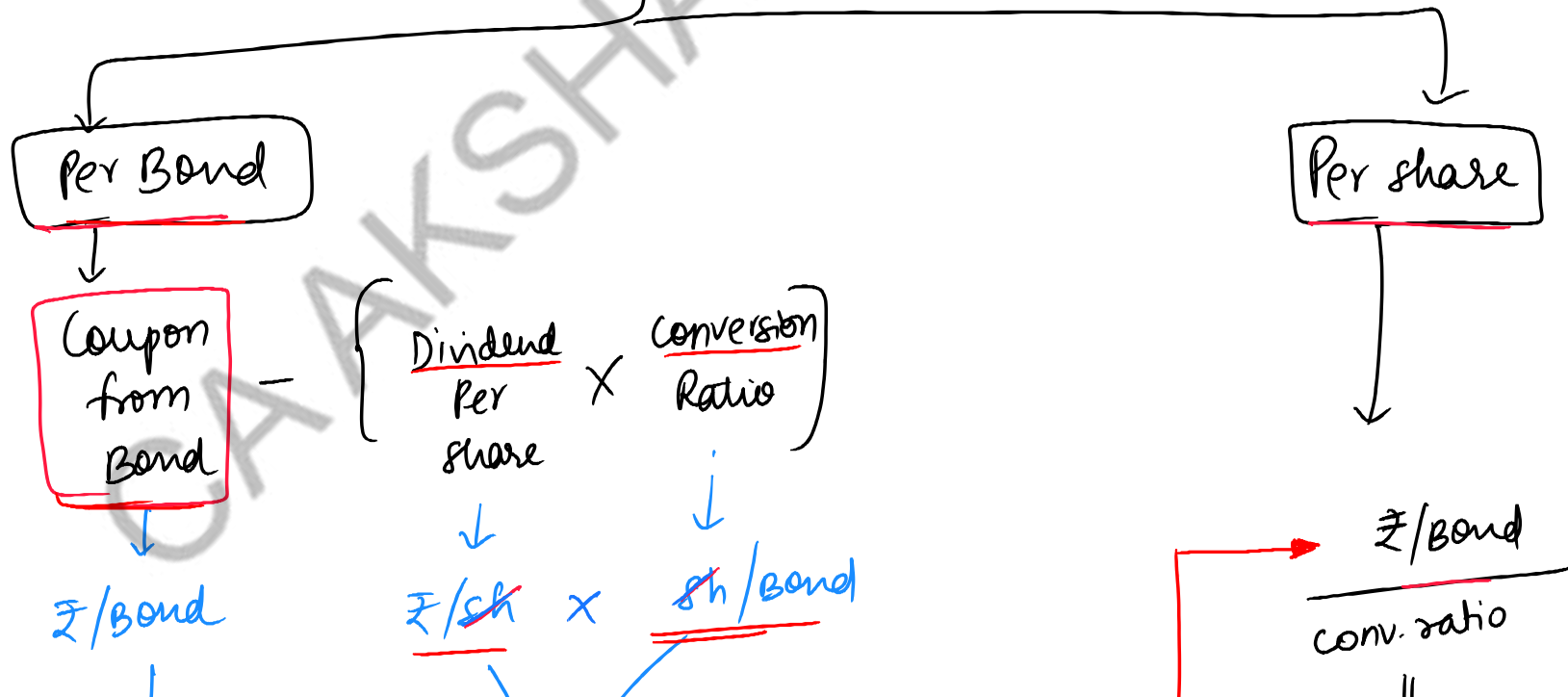
⑤ CONVERSION PREMIUM



⑧ Premium over straight value = Investment value = 100% assurance / risk



⑨ favourable Income Differential



$$\begin{array}{c} \downarrow \\ \boxed{\text{₹/Bond} - \text{₹/Bond}} \\ \downarrow \\ \boxed{\text{₹/Bond}} \end{array}$$

$$\begin{array}{c} \downarrow \\ \frac{\cancel{\text{₹/Bond}}}{\cancel{\text{sh./bond}}} \\ \downarrow \\ \boxed{\text{₹/share}} \end{array}$$

⑩ Payback Period / Breakeven period / Premium Payback Period :-

conversion premium per share (₹/share)

favourable Income Differential per share (₹/share)

Question:-

Given

$$\text{coupon rate} = \underline{8.5\%}$$

$$\text{Issue Price} = \text{face Value} = \underline{\text{₹}1000/\text{Deb.}} \quad] \text{ assumed issued at par}$$

$$\text{Mkt Price of Deb.} = \underline{\text{OCD Value}} = \underline{\text{₹}900/\text{Deb.}}$$

$$\text{Conversion Ratio} = \underline{30 \text{ eq. shares} / \text{Deb.}}$$

$$\text{Straight Value} = \boxed{\text{IV}_0} = \underline{\text{₹}700/\text{Deb.}}$$

$$\text{Share Price} = \underline{\text{₹}25/\text{Eq. share}}$$

$$\text{Expected DPS} = \underline{\text{₹}1/\text{Eq. share}}$$

(a) Conversion Value of Deb.

$$= \text{Conversion ratio} \times \text{share Price}$$

$$= 30 \text{ Eq. shares} / \text{Deb.} \times \text{₹}25 / \text{Eq. share}$$

$$= \boxed{\text{₹}750/\text{Deb.}} = 30 \text{ Eq. shares} \times \text{₹}25$$

(b) Market Conversion Price

$$= \frac{\text{OCD Value}}{\text{Conversion Ratio}} = \frac{\cancel{\text{₹ 900/Deb.}}}{30 \text{ Eq. sh}/\cancel{\text{Deb}}} = \boxed{\text{₹ 30/Eq. share}}$$

(c) Conversion Premium per share

$$\begin{aligned} &= \text{Market Conversion Price} - \text{Share Price} \\ &= \text{₹ 30/Eq. share} - \text{₹ 25/Eq. share} \\ &= \boxed{\text{₹ 5/Eq. share}} \end{aligned}$$

(d) Ratio of Conversion Premium

$$= \frac{\text{Conversion Premium Per share}}{\text{Share Price}}$$

$$= \frac{\cancel{₹ 5 / \text{Eq. share}}}{\cancel{₹ 25 / \text{Eq. share}}} = \boxed{0.20 : 1}$$

(or)

$$\frac{\cancel{₹ 5 / \text{Eq. share}}}{\cancel{₹ 25 / \text{Eq. share}}} \times 100 = \boxed{20\%}$$

(e) Premium over Straight Value

$$\frac{\text{OCD Value} - \text{Straight Value}}{\text{Straight Value}} \times 100$$

$$= \frac{₹ 900 / \text{deb} - ₹ 700 / \text{deb}}{₹ 700 / \text{deb}} \times 100$$

$$= \boxed{28.57\%}$$

$$\frac{\text{OCD Value} - \text{Straight Value}}{\text{OCD Value}} \times 100$$

$$= \frac{₹ 900 / \text{deb} - ₹ 700 / \text{deb}}{₹ 900 / \text{deb}} \times 100$$

$$= \boxed{22.22\%}$$

(f) favourable Income Differential per share

$$= \frac{\text{favourable Income Differential per Bond}}{\text{Conversion Ratio}}$$

$$= \frac{\text{Coupon from Bond} - (\text{Dividend per Share} \times \text{Conversion Ratio})}{\text{Conversion Ratio}}$$

$$= \frac{(\underline{8.5\%} \times \underline{\text{₹}1000/\text{deb}}) - (\underline{\text{₹}1/\text{Eq. share}} \times 30 \text{ Eq. share}/\underline{\text{deb}})}{30 \text{ Eq. share} / \text{Deb}}$$

$$= \frac{₹ 85 / \text{deb} - ₹ 30 / \text{deb}}{30 \text{ Eq. shares} / \text{deb}}$$

$$= \frac{₹ 55 / \cancel{\text{deb}}}{30 \text{ Eq. share} / \cancel{\text{deb}}}$$

$$= \boxed{₹ 1.833 / \text{Eq. share}}$$

(g) Premium Payback Period

$$= \frac{\text{Conversion Premium per share}}{\text{fav. Income Differential per share}}$$

$$= \frac{₹ 5 / \text{Eq. share}}{₹ 1.833 / \text{Eq. share}}$$

$$= \boxed{2.73 \text{ years}}$$

CA AKSHAY RAMNANI

Question :-

Given,

Coupon rate = 10%

Face Value = ₹ 1000 = Redemption Amount (RA)] assumed redeemed at par

Duration = maturity = 10 years = n] (PVIF upto 10 given) imp

$P_0 = \underline{\underline{₹ 850 / Deb}}$

Conversion ratio = 50 Eq. shares / Deb

Share Price = ₹ 17 / Deb

Yield on Comparable Bond = R_e = 11.80%

Spread = ?

spread = Yield of that Bond — Yield on Comparable Bond

$$\text{spread} = \underline{\text{YTM (\%)}} - \underline{\text{Re (\%)}}$$

$$\text{YTM} = \left[\frac{\text{coupon} + \left(\frac{\text{RA} - \text{P}_0}{n} \right)}{\left(\frac{\text{RA} + \text{P}_0}{2} \right)} \right] \times 100$$

$$= \left[\frac{(\underline{10\% \times 1000}) + \left(\frac{1000 - 850}{10} \right)}{\left(\frac{1000 + 850}{2} \right)} \right] \times 100$$

YTM

formula
(approx)

interpolation

11%

13%

$$= \boxed{12.43\%} \text{ (approx)}$$

$$\boxed{\text{spread}} = 12.43\% - 11.80\% = \boxed{0.63\%}$$

FORWARD RATES

Normal case:-

Eg.

RA = face Value = ₹1000

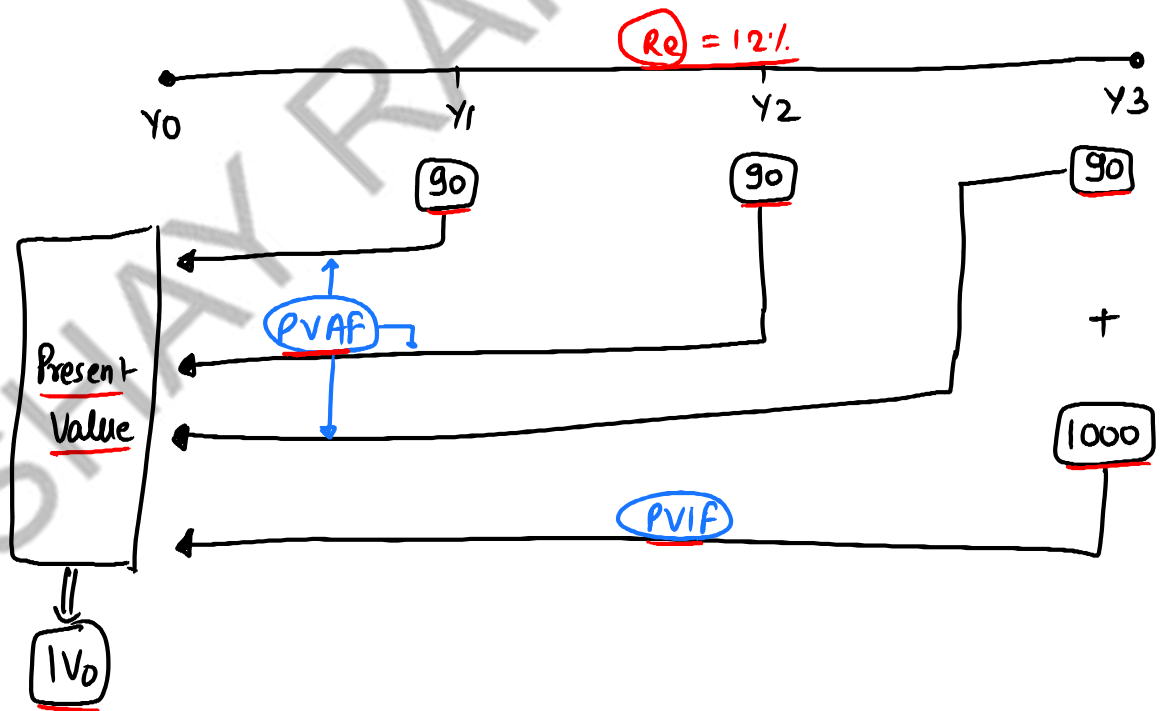
Coupon = 9%

Coupon amount = $9\% \times 1000$
= ₹90

n = 3 years

Re = 12%

Calculate IV_0



$$IV_0 = 90 \times PVAf(12\%, 3) + 1000 \times PVIF(12\%, 3)$$

$$= \underline{90} \times \left[\frac{1}{(1+0.12)^1} + \frac{1}{(1+0.12)^2} + \frac{1}{(1+0.12)^3} \right] + 1000 \times \frac{1}{(1+0.12)^3}$$

$$= \left[\underbrace{\frac{90}{(1+0.12)^1}}_{\substack{\text{Forward} \\ \text{Rate of} \\ \text{1st Year}}} + \underbrace{\frac{90}{(1+0.12)^2}}_{\substack{\text{forward} \\ \text{rate of} \\ \text{2nd Year}}} + \underbrace{\frac{90}{(1+0.12)^3}}_{\substack{\text{forward rate of} \\ \text{3rd Year}}} \right] + \frac{1000}{(1+0.12)^3}$$

Note!

Usually, forward rates of all years in case of $\boxed{I/V_0}$ and $\boxed{P_0}$ are same,
i.e. $\boxed{R_e}$ and $\boxed{Y_{tm}}$ are same for all years to maturity (n).

because, it is assumed that the reinvestment of $\boxed{\text{coupon}}$ and

redemption amount

redemption amount is done at some rate (Re) or (YTM) for all years.

But, Rates can be different for different years, such rates are called forward Rates.

Question:-

Given,

$$\text{coupon} = \underline{9\%}, \text{ coupon amount} = 9\% \times 1000 = \boxed{\underline{90}}$$

$$\text{maturity (n)} = \underline{3 \text{ years}}$$

$$\text{face value} = \underline{\pounds 1000 = RA} \quad] \text{ assumed } \underline{\text{redeemed at par}}$$

Year

forward Rates $\Rightarrow \{Re\}$

1

$$12\% = \boxed{\underline{0.12}}$$

2

$$12\% - 0.75\% = 11.25\% = \boxed{\underline{0.1125}}$$

3

$$11.25\% - \underline{0.50\%} = 10.75\% = \boxed{\underline{0.1075}}$$

$$\underline{IV_0 = ?}$$

$$V_0 = \text{coupon} \times \text{PVAF}(Re, n) + \text{RA} \times \text{PVIF}(Re, n)$$

$$= \frac{90}{(1+0.12)} + \frac{90}{(1+0.12)(1+0.1125)} + \frac{90}{(1+0.12)(1+0.1125)(1+0.1075)}$$

(+)

$$\left[\frac{1000}{(1+0.12)(1+0.1125)(1+0.1075)} \right]$$

$$= \left\{ \boxed{80.35} + \boxed{72.23} + \boxed{65.22} \right\} + \boxed{724.68}$$

$$V_0 = ₹ 942.48$$

Investment

$$80.35 \times (1.12)$$



① 80.35 → 90

② 72.23 → 90

③ 65.22 → 90

Assume ④ 724.68 → 1000

$P_0 = PV_0 \rightarrow 942.48$

investment amount → Present Value [PV]

↑
Cash outflow

Coupons and RA are FUTURE VALUES

↑
Cash inflow

Note :-

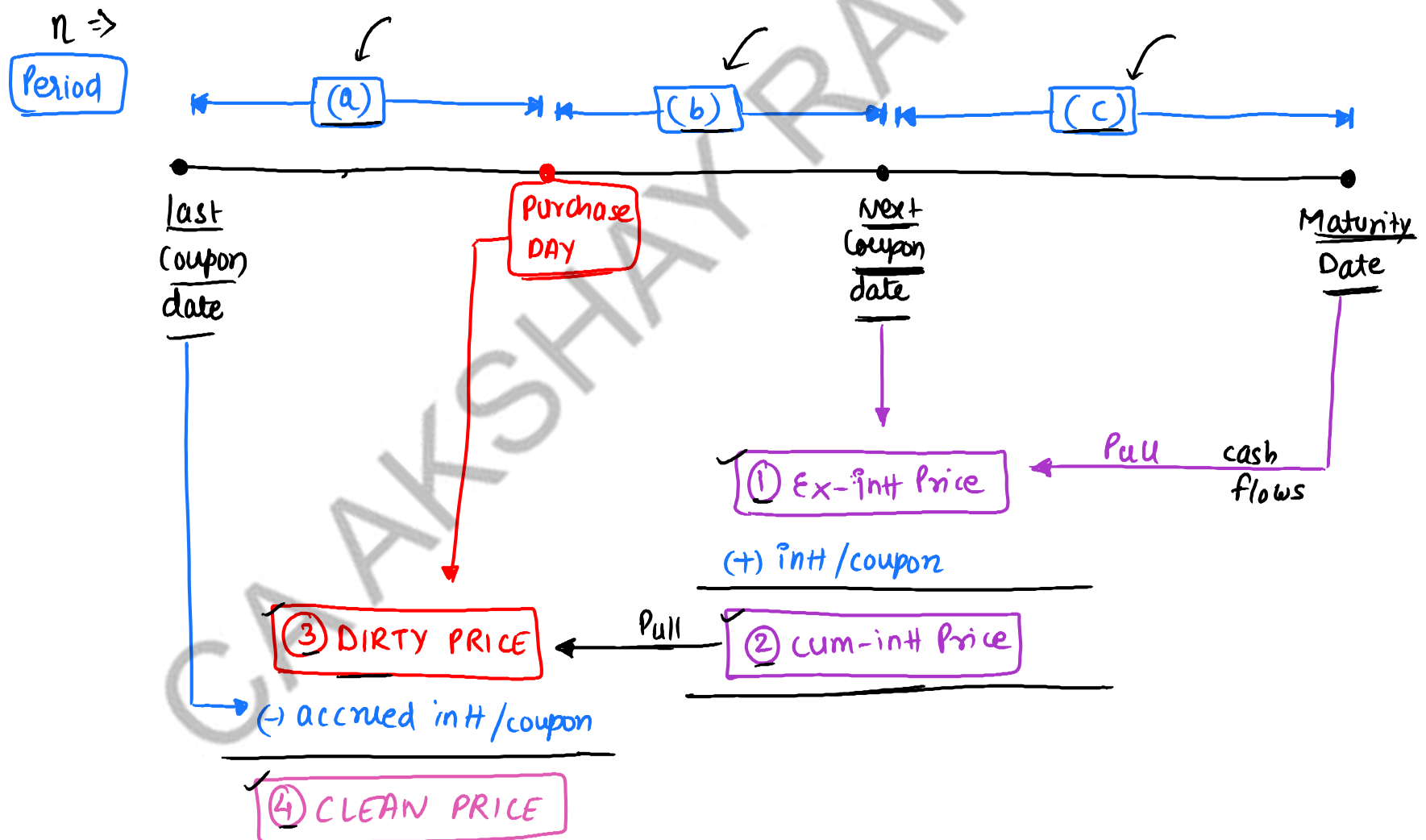
Always Link REINVESTMENT RATE (forward rates) with FUTURE VALUE to understand the concept better.

(99)

$$\begin{aligned}\text{Expected Price of Bond in market} &= \boxed{V_0 \times (1 + \beta)} \\ &= ₹ 948.48 \times 1.02 \\ &= \boxed{₹ 961.33}\end{aligned}$$

CLEAN PRICE & DIRTY PRICE

Calculation of IV_0 (intrinsic value) of Bond when purchased in the middle of year (or) period.



$$\textcircled{1} \text{ Ex-intt Price} = \text{Coupon Amount} \times \text{PVAF}(\text{Re}, (c)) + \text{RA} \times \text{PVIF}(\text{Re}, (c))$$

also called

$$\left\{ \begin{array}{l} \text{Start Proceeds} \\ \text{First leg} \end{array} \right\} = \left[\text{Nominal Value} \times \frac{\textcircled{3} \text{ Dirty Price}}{100} \times \frac{100\% - \text{margin}(\cdot)}{100} \right]$$

$$\textcircled{2} \text{ Cum-intt Price} = \textcircled{1} \text{ Ex-intt Price} + \text{Intt/coupon}$$

also called

$$\left\{ \begin{array}{l} \text{Repayment at Maturity} \\ \text{Second Leg} \end{array} \right\} = \boxed{\text{start Proceeds}} + \left\{ \boxed{\text{start Proceeds}} \times \text{Repo rate} \times \frac{\text{No. of DAYS}}{360} \right\}$$

$$\textcircled{3} \text{ DIRTY PRICE} = \frac{\textcircled{2} \text{ cum intt Price}}{(1 + Re)^{\frac{(b)}{360}}}$$

↓
IV₀

$$\textcircled{4} \text{ Clean Price} = \textcircled{3} \text{ DIRTY PRICE} - \underbrace{\text{accrued int/coupon}}_{\downarrow}$$

↓
"Basic value"

↓
 $\frac{(\text{Face Value} \times \text{coupon\%}) \times \frac{(a)}{12}}{360}$

Question :-

Part (i)

face Value = $P_0 = ₹1000$] sold at par $\rightarrow$ given.

$\Downarrow$

$$\boxed{\text{Coupon rate (\%)} = \text{YTM (\%)}} = \boxed{10\% \text{ p.a.}}$$

Going Interest Rate (%) = $\{Re\}$ = 12% p.a.

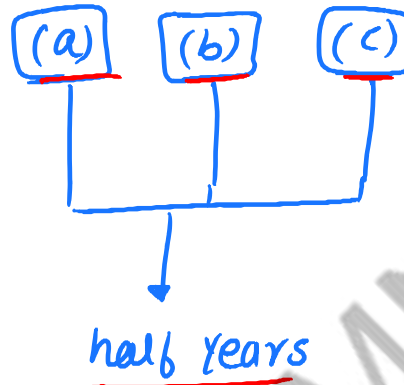
face value = $RA = ₹1000$] assumed redeemed at par

Coupon Amount

$$10\% \times ₹ 1000 = \boxed{₹ 100}$$

$$\frac{₹ 100}{2} = \boxed{₹ 50} \begin{cases} \text{June} \\ \text{December} \end{cases}$$

Maturity Period (n)

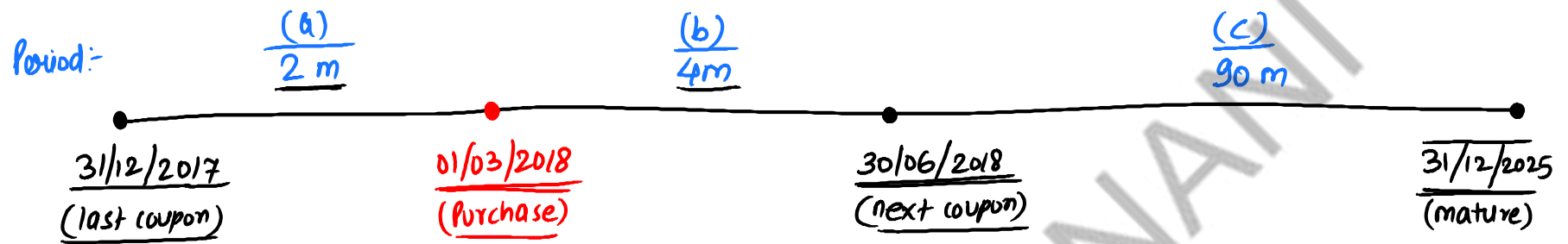


Re. (r)

12% p.a.

$$\frac{12}{2} = \boxed{6\%}$$

Part (99)



Period: (half years)

$\frac{2m}{6m} \rightarrow = \frac{1}{3}$ $\frac{4m}{6m} = \frac{2}{3}$ $\frac{90m}{6m} = 15$

① Ex-int Price = $\boxed{₹50} \times PVA_{\text{F}} \left(6\%, \overset{(c)}{15} \right) + ₹1000 \times PV_{\text{IF}} \left(6\%, 15 \right)$

= $\boxed{₹902.60}$

② Cum int price = $\boxed{\text{① Ex-int Price}} + \text{Int/coupon}$

= $\boxed{₹902.60} + ₹50 = \boxed{₹952.60}$

$$\begin{aligned}
 \textcircled{3} \text{ DIRTY PRICE} &= \frac{\textcircled{2} \text{ cum-intt price}}{(1 + Re)^{(b)}} \\
 &= \frac{₹ 952.60}{(1 + 0.06)^{2/3}} \\
 \text{IV}_0 &= ₹ 916.40
 \end{aligned}$$

$$\textcircled{4} \text{ Clean Price} = \textcircled{3} \text{ Dirty Price} - \text{accrued intt/coupon}$$

$$= ₹ 916.40 - \left[₹ 50 \times \frac{2m}{6m} \right]$$

$$= 916.40 - 16.67$$

$$= \boxed{\text{₹ } 899.73}$$

final answer :-

$$\text{Bond Basic Value (clean price)} = \boxed{\text{₹ } 899.73}$$

$$(+)\text{ Accrued Interest/coupon} = \boxed{\text{₹ } 16.67}$$

$$\text{Amount should be paid to complete transaction (Dirty Price)} = \boxed{\text{₹ } 916.40}$$

Question :-

Given :-

no. of days = 14 days (repo)

Coupon / intt = 12%.

Repo Rate = 5.25%.

Nominal Value = ₹ 5,00,00,000

Clean Price = ₹ 99.42

Initial margin (%) = 2%.

Accrued Intt / coupon days = 292 days

Assumed Face Value = ₹ 100

(a) DIRTY PRICE = Clean Price + accrued Intt / coupon

$$= 99.42 + \left[(12\% \times 100) \times \frac{292 \text{ days}}{360} \right]$$

$$\left[(12\% \times ₹100) \times \frac{212 \text{ days}}{360 \text{ days}} \right]$$

$$\boxed{\text{Dirty Price}} = \boxed{₹109.1533}$$

$$\underline{\text{(b) start Proceeds (First Leg) = EX-INTT PRICE}}$$

$$= \text{Nominal Value} \times \frac{\text{Dirty Price}}{100} \times \frac{100\% - \text{initial margin}(\%)}{100}$$

$$= ₹5,00,00,000 \times \frac{109.1533}{100} \times \frac{100 - 2}{100}$$

=

₹ 5,34,85,117

(or)

₹ 5,34,85,000

(round off)

(c) Repayment at Maturity (Second Leg) = Cum INTT PRICE

$$= \boxed{\text{Start Proceeds}} + \left[\boxed{\text{Start Proceeds}} \times \underset{(\%) \text{ repo rate}}{\text{repo rate}} \times \frac{\text{No. of days (repo)}}{360} \right]$$

$$= ₹ 5,34,85,000 + \left[₹ 5,34,85,000 \times \frac{5.25}{100} \times \frac{14 \text{ days}}{360 \text{ days}} \right]$$

=

₹ 5, 35, 94, 199

CA AKSHAY RAMNANI

Question:-

Given

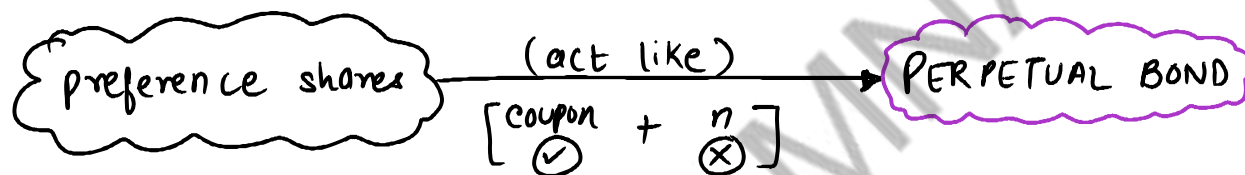
	<u>BOND</u>	
	<u>A</u>	<u>B</u>
face Value = RA (assumed)	₹ 1000	₹ 1000
No.	10 Bonds	10 Bonds
Total RA	₹ 10,000	₹ 10,000
Coupon (%)	9%	10%
Total face Value	₹ 10,000	₹ 10,000
Total coupon Amount	₹ 900	₹ 1000
YTM (%)	12%	12%
maturity (n)	3 years	5 years
Po of all Bonds	⇒ ₹ 9282	₹ 9275

	<u>Preference Shares</u>	
	<u>C</u>	<u>D</u>
face Value	₹ 100	₹ 100
No.	100 pr.sh.	100 pr.sh.
Total Face Value	₹ 10,000	₹ 10,000
Coupon (%) = Fixed Dividend (%)	11%	12%
Fixed Dividend Amount	₹ 1100	₹ 1200
Yield = YTM (%)	13%	13%
	= 0.13	= 0.13

Value

Now, preference shares are not redeemable and carry a fixed dividend (%).

Therefore,



$$\underbrace{\text{Perpetual Bond } P_0}_{\text{value}} \Rightarrow \frac{\text{Coupon Amount}}{\text{YTM}(\cdot\%)}$$



$$\text{Preference Shares value} = \frac{\text{fixed Dividend Amount}}{\text{YTM}(\cdot\%)}$$

$$'C' \text{ value} = \frac{\text{₹ 1100}}{0.13} = \boxed{\text{₹ 8462}}$$

$$'D' \text{ value} = \frac{\text{₹ 1200}}{0.13} = \boxed{\text{₹ 9231}}$$

$$\text{value of Portfolio} = \frac{\text{Bond (A) value}}{} + \frac{\text{Bond (B) value}}{} + \frac{\text{Pref sh (C) value}}{} + \frac{\text{Pref sh. (D) value}}{}$$

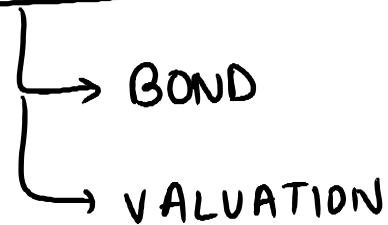
$$= ₹9282 + ₹9275 + ₹8462 + ₹9231$$

→ ₹36,250

INDEX

BOND VALUATION

① BASICS



② Types of Bond

③ Yield to Maturity (YTM)

④ Yields (DY, BEY etc.)

⑤ Price → Decision Table

⑥ Duration of Bond

⑦ Modified Duration of Bond

⑧ Immunisation

⑨ Bond Refunding

⑩ Optionally Convertible Debentures [OCDs]

⑪ Spread (1)

⑫ Forward Rates

⑬ Clean Price & Dirty Price

⑭ Preference Shares $\cong$ Perpetual Bond