Date: 18 th Feb 2021

VIRTUAL COACHING CLASSES
ORGANISED BY BOS (ACADEMIC), ICAI

FOUNDATION LEVEL
PAPER 3: BUSINESS MATHEMATICS, LOGICAL REASONING & STATISTICS

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Time value of money

- **Time value of money:** Time value of money means that **the value of a unity of money is different in different time periods.**
- The sum of **money received in future is less valuable than it is today.**

WHY IS INTEREST PAID? – Pg 4.2 of study material

- **Time value of money:** Time value of money means that the **value of a unity of money** is different in different time periods. The sum of money received in future is less valuable than it is today. In other words the present worth of money received after some time will be less than a money received today
- **Opportunity Cost:** The lender has a choice between using his money in different investments. If he chooses one he forgoes the return from all others. In other words lending incurs an opportunity cost due to the possible alternative uses of the lent money.
- **Inflation:** Most economies generally exhibit inflation. Inflation is a fall in the purchasing power of money. Due to inflation a given amount of money buys fewer goods in the future than it will now. The borrower needs to compensate the lender for this.

Important short-cut in calculation

The difference between simple and compound interest for 2 years = $P.i^2$, where P =Principal, i= interest

The difference between simple and compound interest for 3 years = $3P.i^2 + P.i^3$, where P = Principal i= Interest

Risk & Interest

- **Risk Factor:** There is always a risk that the borrower will go bankrupt or otherwise default on the loan. Risk is a determinable factor in fixing rate of interest.
- Interest = base rate + **risk premium**
- **More the risk, more the interest rate**

Terms

- **Interest**

- Interest is the price paid by a borrower for the use of a lender's money. Simple interest is the interest computed on the principal for the entire period of borrowing. It is calculated on the outstanding principal
  - **Principal**
- Principal is initial value of lending (or borrowing).
  - **Rate of Interest**
- The rate at which the interest is charged for a defined length of time for use of principal , usually annual basis
- Per annum means for a year.
  - **Accumulated amount (or Balance)**
- Accumulated amount is the final value of an investment. It is the sum total of principal and interest earned. Suppose you deposit ` 50,000 in your bank for one year with a interest rate of 5% p.a. you would earn interest of ` 2,500 after one year.
- So **Accumulated amount (or Balance) = Rs 52,500**

Interest

- **Interest:** Interest is the price paid by a borrower for the use of a lender's money. If you borrow (or lend) some money from (or to) a person for a particular period you would pay (or receive) more money than your initial borrowing (or lending).
- **Simple interest:** is the interest computed on the principal for the entire period of borrowing.
- I = Pit
  A = P + I
  I = A – P
  Here, A = Accumulated amount (final value of an investment)
  P = Principal (initial value of an investment)
  i = Annual interest rate in decimal.
  I = Amount of Interest
  t = Time in years

Simple interest

- A = P + I
- = P + Pit
- = P(1 + it) I = A – P
- Here,
- A = Accumulated amount (final value of an investment) P = Principal (initial value of an investment)
- i = Annual interest rate in decimal.
- I = Amount of Interest t = Time in years

Amount $=P\ (1+i)^n$
Compound rate of interest = P(1+i)^n-P= A-P
where P = principle i= interest n =conversion period

- Future value of a **single cash flow** can be computed by above formula.
- Replace A by future value (F) and P by single cash flow (C.F.) therefore
- $F = C.F. (1 + i)^n$
- **Annuity** can be defined as a sequence of periodic payments (or receipts) regularly over a specified period of time.

Annuity application

Annuity *applications*

F = Future value = C.F. $(1 + i)^n$ Where C.F = Cash flow
i= rate of interest, n = time period

Annuity rules

- To be called annuity a series of payments (or receipts) must have following features:
- Amount paid(or received) **must be constant** over the period of annuity and
- Time interval between two consecutive payments (or receipts) **must be the same.**

4.6.1 Annuity regular and Annuity due/immediate

- Annuity regular - First payment/receipt at end of the period
- Annuity due or annuity immediate - First payment/receipt in the first period
- **Table 4.4** - first payment/receipts takes place at the end of first year therefore it is an annuity regular.

Year end	Payments/Receipts (`)
I	5,000
II	5,000
III	5,000
IV	5,000
V	5,000

Annuity regular means :First payment at the end of the period.
Future value of the annuity regular $=A(n,i)= A.\left[\frac{(1+i)^n - 1}{i}\right]$

Annuity regular: In annuity regular first payment/receipt takes place at the end of first period.

Annuity Due or Annuity Immediate

- When the first receipt or payment is made today (at the beginning of the annuity) it is called annuity due or annuity immediate
- first receipt or payment is made in the **beginning of the first year**
- Table 4.5 of study material

In the beginning of	Payment/Receipt (`)
I year	5,000
II year	5,000
III year	5,000
IV year	5,000
V year	5,000

4.7 FUTURE VALUE, pg 4.23 - 24

- Future value is the cash value of an investment at some time in the future. It is tomorrow's value of today's money compounded at the rate of interest.
- Suppose you invest ` 1,000 in a fixed deposit that pays you 7% per annum as interest. At the end of first year you will have ` 1,070.
- This consist of the original principal of ` 1,000 and the interest earned of ` 70. ` 1,070 is the future value of ` 1,000 invested for one year at 7%.

FUTURE VALUE - formula

- Future value of a single cash flow can be computed by above formula.
- Replace A by future value (F) and P by single cash flow (C.F.) therefore
- $F = C.F. (1 + i)^n$

Example 25: pg 4.24

- You invest ` 3000 in a two year investment that pays you 12% per annum. Calculate the future value of the investment.
- $F = C.F. (1 + i)^n$
- where F = Future value
- C.F. = Cash flow = ` 3,000
- i = rate of interest = 0.12 n = time period =2
- $F = ` 3,000(1+0.12)^2$
- = ` 3,000×1.2544
- = ` 3,763.20

4.8 PRESENT VALUE

- The present value P of the amount An due at the end of n period at the rate of i per interest period may be obtained by solving for P the below given equation
- $An = P(1 + i)^n$
- An
- i.e. $P = (1+i)^n$

Present value of annuity due or annuity immediate

- Present value of annuity due/immediate for n years is the same as an annuity regular for (n-1) years plus an initial receipt or payment in beginning of the period.
- Calculating the PV of annuity due involves two steps.
- ***Step 1:*** Compute the present value of annuity as if it were a annuity regular for one period short.
- ***Step 2:*** Add initial cash payment/receipt to the step 1 value.

4.9 SINKING FUND

- It is the fund credited for a specified purpose by way of sequence of periodic payments over a time period at a specified interest rate.
- Interest is compounded at the end of every period.
- Size of the sinking fund deposit is computed from A=P.A(n,i) where A is the amount to be saved,
- P the periodic payment,
- n the payment period

Ex 35

- **Example 35:** How much amount is required to be invested every year so as to accumulate ` 300000 at the end of 10 years if interest is compounded annually at 10%?
- **Solution:** Here A =3,00,000
- n = 10
- i = 0.1
- Since A = P.A (n,i)
- 300000 = P.A.(10, 0.1)
- = P × 15.9374248
- P = 3,00,000 / 15.9374248 = `18,823.62

- **Alternate formula**
- This value can also be calculated by the formula of future value of annuity regular. We know that
- $A = P \{ (1+i)^{n}-1 / i \}$
- = `18,823.62

Example 13 : **Example 23 of pg 4.19**

- Find the amount of compound interest and effective rate of interest if an amount of ` 20,000 is deposited in a bank for one year at the rate of 8% per annum compounded semi annually.

- **Solution:**
- **Compound interest =**
- = ` 20,000 × 0.0816
- = ` 1,632
- Effective rate of interest can also be computed by following formula $E = (1 + i)^n - 1$
- $= (1 + 0.04)^2 - 1$
- =0.0816 or 8.16%

Ex 4B

- 1. ` If P = ` 1,000, R = 5% p.a, n = 4; What is Amount and C.I. is
- (a) ` 1,215.50,`215.50
- (b) ` 1,125, `125
- `( c) 2,115,`115
- (d) none of these
- **Option a is correct**

Ex 4 B No 10

- The C.I on ` 16000 for 1 ½ years at 10% p.a payable half -yearlyis
- (a)`2,222 (b)`2,522 (c)`2,500 (d) none of these

- Ans = 2522 , b

Ex 4B – Qu 14

- Qu 14. The C.I on ` 4,000 for 6 months at 12% p.a payable quarterly is
- (a)`243.60 (b)`240 (c)`243 (d) none of these
- Here i= 12/4= 3 %
- n= 2

- Ans a, 243.6

THANK YOU