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VIRTUAL COACHING CLASSES
ORGANISED BY BOS (ACADEMIC), ICAI

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

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Discussion Points

- Day 3:
- Use of PV in leasing, bond valuation and capital expenditure
- Compounded Annual Growth Rate (CAGR)
- Study material questions, CA exam & MTP questions & solutions

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4.10 APPLICATIONS, Pg 4.34

Leasing is a financial arrangement under which the owner of the asset (lessor) allows the user of the asset (lessee) to use the asset for a defined period of time (lease period) for a consideration (lease rental) payable over a given period of time.

This is a kind of taking an asset on rent.

How can we decide whether a lease agreement is favourable to lessor or lessee

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Example 36, pg 4.34

- ABC Ltd. wants to lease out an asset costing ` 3,60,000 for a five year period. It has fixed a rental of ` 1,05,000 per annum payable annually starting from the end of first year. Suppose rate of interest is 14% per annum compounded annually on which money can be invested by the company. Is this agreement favourable to the company?

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- **Solution:** First we have to compute the present value of the annuity of ` 1,05,000 for five years at the interest rate of 14% p.a. compounded annually.
- The present value V of the annuity is given by V = A.P (n,i)
- = 1,05,000 × P(5, 0.14)
- = 1,0,5000 × 3.43308 = ` 3,60,473.40
- which is greater than the initial cost of the asset and consequently leasing is favourable to the lessor.

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- **Example 37:** A company is considering proposal of purchasing a machine either by making full payment of ` 4,000 or by leasing it for four years at an annual rate of ` 1,250. Which course of action is preferable if the company can borrow money at 14% compounded annually?

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- **Solution:** The present value V of annuity is given by V = A.P (n, i)
- = 1,250 × P (4, 0.14)
- = 1,250 × 2.91371 = ` 3,642.11
- which is less than the purchase price and consequently leasing is preferable.

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4.10.2 Capital Expenditure (investment decision)

- **Capital expenditure means purchasing an asset (which results in outflows of money) today in anticipation of benefits (cash inflow) which would flow across the life of the investment.**
- **For taking investment decision we compare the present value of cash outflow and present value of cash inflows.**
- If PV of cash inflows is greater than PV of cash outflows decision should be in the favour of investment
- **CFS = AS 3 : Investing decision**

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Example 38:

- A machine can be purchased for ` 50000. Machine will contribute ` 12000 per year for the next five years. Assume borrowing cost is 10% per annum compounded annually. Determine whether machine should be purchased or not.
- **Solution:** The present value of annual contribution V = A.P(n, i)
- = 12,000 × P(5, 0.10)
- = 12,000 × 3.79079
- = ` 45,489.48
- which is less than the initial cost of the machine. Therefore machine must not be purchased.

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Example 39 , pg 4.35

- **Example 39:** A machine with useful life of seven years costs ` 10,000 while another machine with useful life of five years costs ` 8,000. The first machine saves labour expenses of ` 1,900 annuallyandthesecondonesaveslabourexpensesof`2,200annually.Determinethepreferred course of action. Assume cost of borrowing as 10% compounded per annum.
- **Solution:** The present value of annual cost savings for the first machine
- = ` 1,900 × P (7, 0.10)
- = ` 1,900 × 4.86842
- = ` 9,249.99
- = ` 9,250
- Cost of machine being ` 10,000 it costs more by ` 750 than it saves in terms of labour cost. The present value of annual cost savings of the second machine
- = ` 2,200 × P(5, 0.10)
- = ` 2,200 × 3.79079
- = ` 8,339.74
- Cost of the second machine being ` 8,000 effective savings in labour cost is ` 339.74. Hence the second machine is preferable.

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4.10.3 **Valuation of Bond**

- **A bond is a debt security in which the issuer owes the holder a debt and is obliged to repay the principal and interest. Bonds are generally issued for a fixed term longer than one year.**
- **Example 40:** An investor intends purchasing a three year ` 1,000 par value bond having nominal interest rate of 10%. At what price the bond may be purchased now if it matures at par and the investor requires a rate of return of 14%?

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Solution

- **Solution:** Present value of the bond
- $100 / (1+0.14)^1 + 100 / (1 +0.14)^2 + 100 / + (1 +0.14)^3 + 1{,}000 / (1+0.14)^3$
- $100 \times 0.87719 + 100 \times 0.769467 + 100 \times 0.674\,972 + 1{,}000 \times 0.674972$
- $= 87.719 + 76.947 + 67.497 + 674.972$
- $= 907.125$
- Thus the purchase value of the bond is ` 907.125

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4.11 PERPETUITY

- Perpetuity is an annuity in which the periodic payments or receipts begin on a fixed date and continue indefinitely or perpetually. Fixed coupon payments on permanently invested (irredeemable) sums of money are prime examples of perpetuities.
- The formula for evaluating perpetuity is relatively straight forward. Two points which are important to understand in this regard are:.
- The value of the perpetuity is finite because receipts that are anticipated far in the future have extremely low present value (today's value of the future cashflows).
- Additionally, **because the principal is never repaid**, there is **no present value for the principal.**
- Therefore, the price of perpetuity is simply the coupon amount over the appropriate discount rate or yield.
- **PVA ' = R/ i**
- Where:
- R = the payment or receipt each period
- i = the interest rate per payment or receipt period

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- **Example 41: pg 4.36**
- Ramesh wants to retire and receive ` 3,000 a month. He wants to pass this monthly payment to future generations after his death. He can earn an interest of 8% compounded annually. How much will he need to set aside to achieve his perpetuity goal?
- **Solution:**
- R = ` 3,000
- i = 0.08/12 or 0.00667
- Substituting these values in the above formula, we get
- PVA =`3,000
- 0.00667
- = ` 4,49,775
- If he wanted the payments to start today, he must increase the size of the funds to handle the first payment. This is achieved by depositing ` 4,52,775 (PV of normal perpetuity + perpetuity received in the beginning = 4,49,775 + 3,000) which provides the immediate payment of ` 3,000 and leaves ` 4,49,775 in the fund to provide the future ` 3,000 payments.

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Calculation of Growing Perpetuity:

- A stream of cash flows that grows at a constant rate forever is known as growing perpetuity
- PV of growing perpetuity : PVA = R / i –g

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- **Example 42:** Assuming that the discount rate is 7% per annum, how much would you pay to receive ` 50, growing at 5%, annually, forever?
- **Solution:**
- PVA =
- R /i –g
- = 50 / 0.07 -0.05
- =2,500

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NPV

- **Net Present Value Technique (NPV):** The net present value technique is a discounted cash flow method that considers the time value of money in evaluating capital investments. An investment has cash flows throughout its life, and it is assumed that a rupee of cash flow in the early years of an investment is worth more than a rupee of cash flow in a later year
- The net present value method uses a specified discount rate to bring all subsequent net cash inflows after the initial investment to their present values (the time of the initial investment is year 0).

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Determining Discount Rate

- Theoretically, the discount rate or desired rate of return on an investment is the rate of return the firm would have earned by investing the same funds in the best available alternative investment that has the same risk. Determining the best alternative opportunity available is difficult in practical terms so rather that using the true opportunity cost, organizations often use an alternative measure for the desired rate of return. An organization may establish a minimum rate of return that all capital projects must meet; this minimum could be based on an industry average or the cost of other investment opportunities. Many organizations choose to use the overall **cost of capital or Weighted Average Cost of Capital (WACC)** that an organization has incurred in raising funds or expects to incur in raising the funds needed for an investment.
- The NPV of a project is the amount, in current value of rupees, the investment earns after paying cost of capital in each period.

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NET PRESENT VALUE

- **Net present value = Present value of net cash inflow – Total net initial investment**
- Since it might be possible that some additional investment may also be required during the life time of the project then appropriate formula shall be:
- **Net present value = Present value of cash inflow – Present value of cash outflow**

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- The steps to calculating net present value are:-
- Determine the net cash inflow in each year of the investment.
- Select the desired rate of return or discounting rate or Weighted Average Cost of Capital. 3. Find the discount factor for each year based on the desired rate of return selected.
- Determine the present values of the net cash flows by multiplying the cash flows by respective the discount factors of respective period called Present Value (PV) of Cash flows
- Total the amounts of all PVs of Cash Flows
- **Decision Rule:**
- If NPV≥0 Accept the Proposal If NPV≤0 Reject the Proposal

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Example 43: Pg 4.38

- Compute the net present value for a project with a net investment of ` 1,00,000 and net cash flows year one is ` 55,000; for year two is ` 80,000 and for year three is ` 15,000. Further, the company's cost of capital is10%?
- [PVIF @ 10% for three years are 0.909, 0.826 and 0.751]

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Solution

Recommendation: Since the net present value of the project is positive, the company should accept the project.

Year	*Net Cash Flows*	*PVIF @ 10%*	*Discounted Cash Flows*
0	(1,00,000)	1.000	(1,00,000)
1	55,000	0.909	49,995
2	80,000	0.826	66,080
3	15,000	0.751	11,265
Net Present Value			27,340

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4.13 NOMINAL RATE OFRETURN pg 4.39

- The nominal rate is the stated interest rate. If a bank pays 5% annually on a savings account, then 5% is the nominal interest rate. So if you deposit ` 100 for 1 year, you will receive ` 5 in interest. However, that ` 5 will probably be worth less at the end of the year than it would have been at the beginning. This is because inflation lowers the value of money. As goods, services, and assets, such as real estate, rise in price.
- **Real Rate of Return:** The real interest rate is so named because it states the "real" rate that the lender or investor receives after inflation is factored in; that is, the interest rate that exceeds the inflation rate.
- A comparison of real and nominal interest rates can therefore be summed up in this equation:
- **Nominal Rate of Return – Inflation = Real Rate of Return**
- **Nominal Interest Rate = Real Interest Rate + Inflation**

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4.14 COMPOUND ANNUAL GROWTH RATE(CAGR)

- Compounded Annual Growth Rate (CAGR) is a business and investing specific term for the smoothed annualized gain of an investment over a given time periodic is not an accounting term, but remains widely used, particularly in growth industries or to compare the growth rates of two investments because CAGR dampens the effect of volatility of periodic returns that can render arithmetic means irrelevant. CAGR is often used to describe the growth over a period of time – revenue , registered users , profits etc

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Applications: CAGR

- **These are some of the common CAGR applications:**
- Calculating average returns of investment funds.
- Demonstrating and comparing the performance of investment advisors.
- Comparing the historical returns of stocks with bonds or with a savings account.
- Forecasting future values based on the CAGR of a data series.
- Analyzing and communicating the behavior, over a series of years, of different business measures such as sales, market share, costs, customer satisfaction, and performance

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Additional question

25. How much amount is required to be invested every year so as to accumulate ₹ 5,00,000 at the end of 10 years if interest is compounded annually at 10%? Given A. (10, 0.1)= 15.9374248

Solution: Here $A = 500000, n = 10, A(n,i) = \left[\frac{(1+i)^n - 1}{i}\right] = \left[\frac{(1+01)^{10} - 1}{0.1}\right] = 15.9374248$

since $A = P.\ A.\ (n, i)$

$500000 = P\ A.\ (10, 0.1) = P \times 15.9374248$

$P = \left[\frac{500000}{15.9374248}\right] = ₹\ 31372.70$

THANK YOU

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