Chapter 24: Time Value of Money

Introduction

In the world of finance and accounting, the **Time Value of Money (TVM)** is a fundamental principle. It means that **money available today is worth more than the same amount in the future**, due to its potential earning capacity. This core concept forms the basis for many financial decisions, such as investment appraisals, project evaluations, loan computations, and retirement planning.

For a BTech CSE student entering the corporate world or managing startup finances, understanding TVM is crucial in areas like budgeting, assessing profitability, or making funding decisions in tech projects.

24.1 Concept of Time Value of Money

- **Definition**: The idea that money received today has more value than money received in the future due to its ability to earn returns (interest or investment income).
- **Reasons for TVM**:
    - **Inflation**: Reduces the purchasing power of money over time.
    - **Opportunity cost**: Money today can be invested to earn returns.
    - **Risk and uncertainty**: Future money is uncertain; present money is guaranteed.

24.2 Components Influencing TVM

1. **Principal (P)** – The original amount of money invested or borrowed.
2. **Interest rate (r or i)** – The rate at which money grows over time.
3. **Time period (t or n)** – The duration for which money is invested or borrowed.
4. **Frequency of compounding** – How often interest is calculated (annually, semi-annually, monthly).

24.3 Types of Interest

24.3.1 Simple Interest (SI)

- Formula:

$$SI = \frac{P \times r \times t}{100}$$

- Interest is calculated on the **initial principal** only.
- Used in short-term loans or deposits.

24.3.2 Compound Interest (CI)

- Formula:

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$CI = A - P$$

  Where:

  - A = final amount
  - P = principal
  - r = annual interest rate
  - n = number of compounding periods per year
  - t = number of years

- Interest is calculated on the **principal + accumulated interest**.
- More realistic for real-world financial decisions.

24.4 Future Value (FV) and Present Value (PV)

24.4.1 Future Value (FV)

The value of current money at a future date, given interest earnings.

- Formula:

$$FV = PV \times ¿$$

24.4.2 Present Value (PV)

The current worth of money to be received in the future.

- Formula:

$$PV = \frac{FV}{¿¿}$$

Example:

If ₹10,000 is invested at 10% interest for 2 years:

$$FV = 10,000 \times ¿$$

24.5 Annuities

An **annuity** is a series of equal payments made at regular intervals.

24.5.1 Types of Annuities

- **Ordinary Annuity** – Payments made at the **end** of each period.
- **Annuity Due** – Payments made at the **beginning** of each period.
- **Perpetuity** – Infinite series of payments.

24.5.2 Present Value of an Annuity (PVA)

$$PVA = PMT \times ¿$$

24.5.3 Future Value of an Annuity (FVA)

$$FVA = PMT \times ¿$$

Where:

- PMT = periodic payment
- r = interest rate
- n = number of periods

24.6 Applications of TVM in Business & Tech Startups

- **Capital Budgeting**: Evaluate whether a project is worth investing in.
- **Loan Amortization**: Understanding EMIs and repayment schedules.
- **Valuation of Investments**: Stocks, bonds, or mutual funds.
- **Startup Planning**: Determining break-even points and funding needs.
- **Software Cost Justification**: When building custom software or licensing.

24.7 Discounted Cash Flow (DCF) Analysis

DCF is a valuation method using **TVM** to estimate the attractiveness of investments.

$$NPV = \sum ¿$$

Where:

- CF_t = cash flow at time t
- r = discount rate
- t = time period
- **Positive NPV** → Accept project
- **Negative NPV** → Reject project

24.8 Internal Rate of Return (IRR)

The discount rate at which **NPV = 0**. It's used to assess the profitability of investments.

- If IRR > required return → Accept project
- Used in comparison with DCF

24.9 Continuous Compounding

When compounding occurs **infinitely frequently**.

- Formula:

  $$FV = P \times e^{rt}$$

  Where $e \approx 2.718$

24.10 Key Takeaways for Tech Students

- Financial literacy is essential for tech professionals, founders, and product managers.

- TVM helps compare projects, forecast revenue, and manage capital effectively.
- Real-world applications: EMIs, software project returns, investor valuations.

Summary

The **Time Value of Money (TVM)** is the backbone of financial decision-making. By understanding concepts like **simple and compound interest, present and future values, annuities, and DCF**, you can evaluate the financial feasibility of projects, both personal and professional. As a BTech CSE graduate, this knowledge bridges your technical capabilities with strategic business decisions.
