

## Engineering Economics & Costing

Module-II:

(12 hours)

### Cost and revenue concepts,

Basic understanding of different market structures,

Determination of equilibrium price under perfect competition (Simple numerical problems to be solved),

Break Even Analysis-linear approach (Simple numerical problems to be solved).

### Banking –

Commercial bank, Functions of commercial bank,

Central bank, Functions of Central Bank.

### Inflation-

Meaning of inflation, types, causes, measures to control inflation.

### National Income-

Definition, Concepts of national income, Method of measuring national income.

---

### 1. Cost concept -

It is the amount of resources given up in exchange for some goods or services . the resources given up should be in monetary term.

Definition- cost is defined as the amount of expenditure incurred on or attributable to a specific thing or activity.

Cost Accounting may be regarded as “a specialized branch of accounting which involves classification, accumulation, assignment and control of costs.”

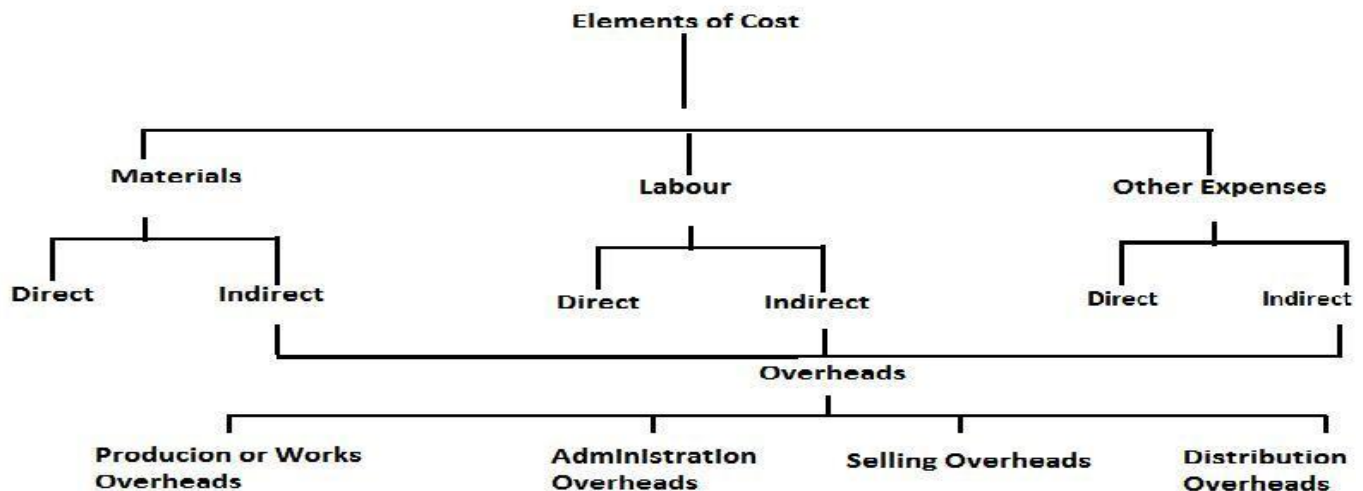
Cost accounting is the process of determining and accumulating the cost of product or activity.

It is a process of accounting for the incurrence and the control of cost. The costing terminology of C.I.M.A ., London defines costing as the “the techniques and processes of ascertaining costs”.

### Elements of Cost-

The management of an organization needs necessary data to analyze and classify costs for proper control and for taking decisions for future course of action. Hence the total cost is analyzed by elements of costs ie by the nature of expenses. The elements of costs are three

and they are materials, labour and other expenses. These can be further analyzed as follows.



These terms can be explained as follows

1. **Direct Materials** are those materials which can be identified in the product and can be conveniently measured and directly charged to the product. For example, bricks in houses, wood in furniture etc. Hence all raw materials, materials purchased specifically for a job or process like glue for book making, parts or components purchased or produced like batteries for radios and tyres for cycles, and primary packing materials are direct materials.
2. **Indirect Materials** are those materials which cannot be classified as direct materials. Examples are consumables like cotton waste, lubricants, brooms, rags, cleaning materials, materials for repairs and maintenance of fixed assets, high speed diesel used in power generators etc.
3. **Direct Labour** is all labour expended in altering the construction, composition, confirmation or condition of the product. Thus direct wages means the wages of labour which can be conveniently identified or attributed wholly to a particular job, product or process or expended in converting raw materials into finished goods. Thus payment made to groups of labourers engaged in actual production, or carrying out of an operation or process, or supervision, maintenance, tools setting, transportation of

materials, inspection, analysis etc is direct labour.

4. **Direct Expenses** are expenses directly identified to a particular cost centre. Hence expenses incurred for a particular product, job, department etc are direct expenses. Example royalty, excise duty, hire charges of a specific plant and equipment, cost of any experimental work carried out especially for a particular job, travelling expenses incurred in connection with a particular contract or job etc.

5. **Overheads** may be defined as the aggregate of the cost of indirect materials, indirect labour and such other expenses including services as cannot conveniently be charged direct to specific cost units. Overheads may be sub-divided into (i) Manufacturing Overheads; (ii) Administration Overheads; (iii) Selling Overheads; (iv) Distribution Overheads; (v) Research and Development Overheads.

## 7. Cost sheet or Statement of Cost:

### Cost sheet:

When costing information is presented in the form of a statement, it is called "Cost Sheet". It is usually adopted when there is only one main product and all costs almost are incurred for that product only. Cost sheet is a device used to determine and present the cost under unit costing. It is a statement of costs incurred at each level of manufacturing a product or service. In a Cost sheet all the elements of cost is taken into consideration. It includes Prime cost, Factory/manufacturing cost, cost of production, cost of sale Profit/loss etc. The information incorporated in a cost sheet would depend upon the requirement of management for the purpose of control.

Items excluded from Cost Sheet:

1. Pure financial expenses like interest on capital, interest on loan, discount on debentures, loss on sale of fixed asset provision for bad debts and doubtful debts, writing off goodwill, copyright, preliminary expenses etc.
2. Pure financial incomes like interest received, profit on sale of investment, dividend received, rent received, commission received, discount received etc.

In addition to the above, no appropriation items will include in cost sheet.

Specimen of Cost Sheet or Statement of Cost

Specimen of Cost Sheet or Statement of Cost		
	Total cost	Cost per unit
	Rs	Rs
Direct Materials	xxx	xxx
Direct Labour	xxx	xxx
	Prime cost	xxxx
Add factory over head	xxx	xxx
	Factory cost	xxxx
Add office overhead	xxx	xxx
	Cost of production	xxxx
Add selling and distribution over head	xxx	xxx
	Cost of sale	xxxx
	Add profit	xxx
	Total sale	xxxx

**Illustration 1:** Calculate Prime Cost, Factory Cost, Cost of Production, Cost of Sales and profit from the following particulars:

	Rs.		Rs.
Direct Materials	1,00,000	Consumable Stores	2,500
Direct Wages	30,000	Manager's Salary	5,000
Wages of Foreman	2,500	Directors' fees	1,250
Electric power	500	Office Stationery	500
Lighting: Factory	1,500	Telephone Charges	125
Lighting :Office	500	Postage and Telegrams	250
Storekeeper's wage's	1,000	Sales man salary's	1250
Oil and water	500	Travelling expenses	500

Rent: Factory	5,000	Advertising	1250
Rent :Office	2,500	Warehouse charges	500
Repairs and renewal factory plant	3500	Sales	1.89.500
Transfer to Reserves	1,000	Carriage outward	375
Discount on shares written off	500	Dividend	2,000
Depreciation: Factory Plant	500		
Depreciation: office	1,250		

<b>Specimen of Cost Sheet or Statement of Cost</b>			
			Total cost
			Rs
Direct Materials		1,00,000	
Direct Labour		30,000	
	Prime cost		1,30,000
Add factory over head			
	Wages of foreman	2,500	
	Electric power	500	
	Storekeeper's Wages	1,000	
	Oil and Water	500	
	Factory rent	5,000	
	Repairs and -Factory renewal Plants	3,500	
	Factory lighting	1,500	
	Depreciation -Factory Plant	500	
	Consumable stores	2,500	17,500
	Factory cost		1,47,500
Add office overhead			
	Office rent	2,500	
	Repairs and Renewals Office Premises	500	
	Office lighting	500	
	Depreciation : Office Premises	1,250	
	Manager's Salary	5,000	
	Director's fees	1,250	
	Office Stationery	500	

	Telephone charges	125	
	Postage and telegrams	250	11,875
	Cost of production		1,59,375
Add selling and distribution over head			
	Carriage Outward	375	
	Salesmen's Salaries	1,250	
	Travelling Expenses	500	
	Advertising	1,250	
	Warehouse charges	500	3,875
	Cost of sale		1,63,250
	profit		26,250
	Total sale		1.89.500

### Treatment of Stock:

While preparing a cost sheet we have to consider the opening and closing stocks of the following three items.

1. Stock of Raw materials. 2. Stock of finished goods, 3. Stock of work in progress

1. **Stock of Raw materials:** In order to get the cost of material consumed, opening stock of material is added to the cost of raw materials purchased and closing stock of raw materials is deducted from it.

Opening stock of raw materials		xxx
Add Purchase of RM	(+)	xxx
		-----
		xxx
Less closing stock of RM	(-)	xx
		-----
Cost of materials consumed		xxx
		=====

2. **Stock of Work – in – progress:** The Cost of work in progress are adjusted at the work cost stage

Prime cost	xxx
------------	-----

Add works OH	(+)	xxx		
		Xxx		
Add opening stock of WIP (+)		xx		
		xxx		
Less closing stock of WIP (-)		xx		
Works cost		xxxx		
		=====		

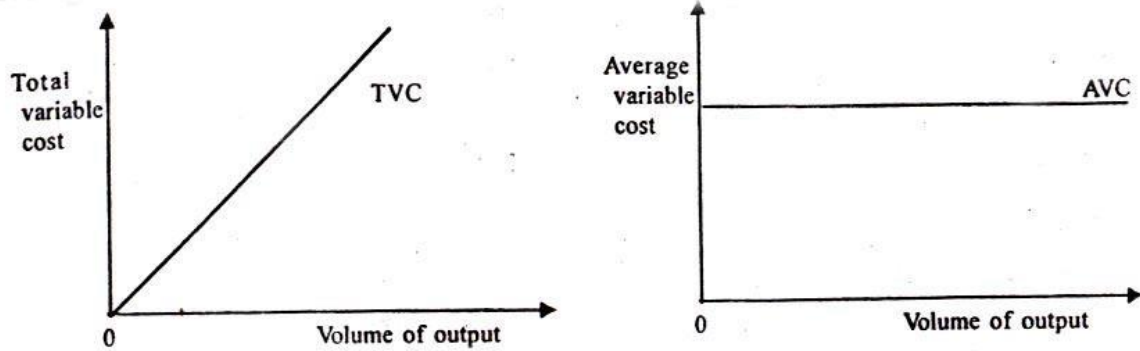
3. **Stock of finished goods:** It is adjusted immediately after ascertaining the cost of production.

Cost of production		xxx		
Add opening stock of FG	(+)	xx		
		Xxxx		
Less closing stock of FG	(-)	xxx		
Cost of Goods sold		xxxx		
		=====		

### Segregation of costs into fixed and variable costs.

#### 1. Fixed Costs:

Fixed cost are those costs which remain fixed in total amount with increase or decrease in the volume of the output or productive activity for a given period of time. Fixed cost is a cost which does not vary in total for a given time period in spite of wide fluctuation in production or volume of activity. These costs are also termed as standby costs, capacity costs or period costs. Fixed Costs per unit decreases as production increases and vice versa. Eg:- rent, insurance of factory building, factory manager's salary etc.



## 2. Variable Costs -

Variable Costs are those costs which vary in direct proportion to the volume of output. These costs fluctuate in total but remain constant per unit as production activity changes. Eg:- direct material costs, direct labour costs, power, repairs etc.

## 8. Linear Break-Even Analysis

The broader interpretation refers to that system of analysis which determines the probable profit at any level of activity. The relationship among cost of production, volume of production, the profit and the sales value is established by break-even analysis. Hence, this analysis is also designated as 'Cost-volume-profit' analysis.

### Break-even point

The point, (volume of sale or volume of production) at which there shall be neither profit nor loss, is regarded as break-even point. At this point, the income of the business exactly equals its expenditure.

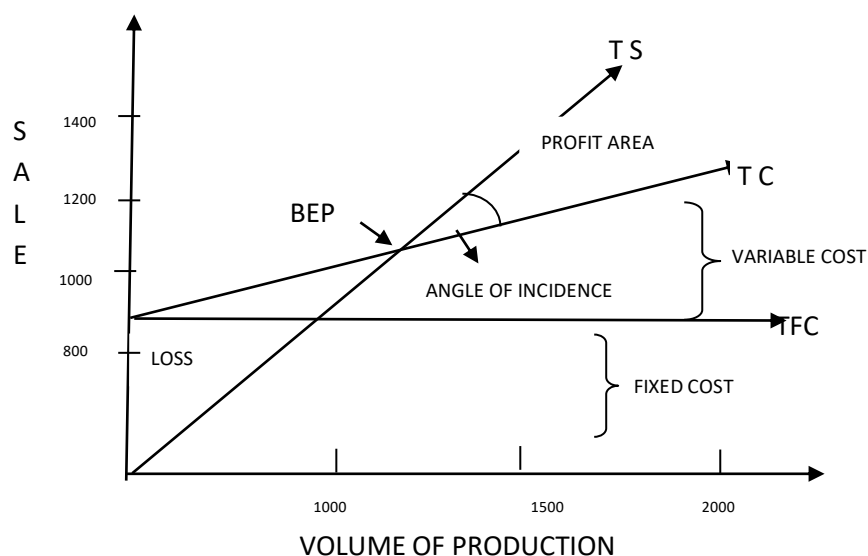
### Assumption

basic assumptions for breakeven analysis are:

- The behavior of both costs and revenues is linear throughout the relevant range of activity. (This assumption rule out the concept of volume discounts on either purchased materials or sales.)
- Changes in activity are the only factors that affect costs.
- Costs can be classified accurately as either fixed or variable.
- Constant total fixed cost;
- Variable cost must be directly proportional to output and variable cost per unit must be constant;
- All units produced are sold (there is no ending finished goods inventory).



- When a company sells more than one type of product, the sales mix (the ratio of each product to total sales) will remain constant.
- Constant sales price;



T.S= total sale T C = Total cost BEP = Break Even Point

### Construction of Break-even Chart:

Construction of break-even chart involves the drawing of fixed cost line, total cost line, and sales line as follows :-

- (1) Select a scale for production on the horizontal axis and a scale for costs and sales on the vertical axis.
- (2) Plot the fixed cost on the vertical axis and draw fixed cost line passing through this point parallel to horizontal axis.
- (3) Plot the variable costs for some activity levels starting from the fixed cost line and join these points. This will give the total cost line. Alternatively, obtain total cost at different levels, plot the points starting from horizontal axis and draw the total cost line.
- (4) Plot the maximum or any other sales volume and draw the sales line by joining zero and the point so obtained.

**Mathematical formula :**

Marginal cost = Total variable cost

Or = Total cost – Fixed cost

Or = Direct Material + Direct labour+ Direct Expenses (Variable)+ Variable overheads

Contribution = Selling Price – Variable cost

Profit = Contribution – Fixed cost

Fixed cost = Contribution – Profit

Contribution = Fixed cost + Profit

$$\text{Profit/Volume Ratio} = \frac{\text{Contribution per unit}}{\text{Selling price per unit}}$$

$$\text{Or} = \frac{\text{Total contribution}}{\text{Total sales}}$$

In case P/V ratio is to be expressed as a percentage of sales, 100 as given above should multiply the figure derived from the formulae.

$$\text{Break-even point} = \frac{\text{Fixed cost}}{\text{Contribution per unit}}$$

$$\text{Break-even point} = \frac{\text{Fixed cost}}{\text{Total contribution}} \times \text{Total sale}$$

$$\text{Break-even point} = \frac{\text{Fixed cost}}{1 - \frac{\text{Variable cost}}{\text{Selling price per unit}}}$$

$$\text{Break-even point} = \frac{\text{Fixed cost}}{\text{P / V Ratio}}$$

At break-even point the desired profit is zero, in case the volume of output of sales is to be computed for 'a desired profit', the amount of 'desired profit' should be added to Fixed Costs in the formulae given above.

For example:

Units for a desired profit = (Fixed cost + Desired profit) / Contribution per unit

Sales for a desired profit =(Fixed cost + Desired profit) / (P/V Ratio)

This will be clear from the following illustrations:

**Illustration 1:** A factory manufacturing sewing machines has the capacity to produce 500 machines per annum. The marginal (variable) cost of each machine is Rs. 400 and each

machine is sold for Rs. 450. Fixed overheads are Rs. 24,000 per annum. Calculate the break-even points for output and sales and show what profit will result if output is 90% of capacity?

**Solution:** Contribution per machine is Rs. 450 – Rs. 400 = Rs. 50.

Break-even point for output (Output, which will give 'contribution' equal to fixed costs Rs. 12,000)

$$\begin{aligned} \text{B.E.P. for output} &= \text{Total fixed cost} / \text{Contribution per unit} \\ &= 24,000 / 50 \\ &= 480 \text{ machines} \end{aligned}$$

### Break-even point for sales

$$\begin{aligned} &= \text{Output} \times \text{Selling price per unit} \\ &= 480 \times \text{Rs. } 450 = \text{Rs. } 2,16,000 \end{aligned}$$

Break-even point for sales can also be calculated with the help of any of the following formulae:

$$\begin{aligned} \text{(i) B.E.P.} &= (\text{Total fixed cost}) / (1 - (\text{Variable cost per unit} / \text{Selling price per unit})) \\ &= 24,000 / (1 - (400 / 450)) \\ &= 24,000 / (1 - 0.888888) = 24,000 / (0.11111) \\ &= \text{Rs. } 2,16,000 \end{aligned}$$

### Margin Of Safety (MoS) -

Margin of safety is the excess over the break-even sales, and represents the strength of the organisation. A high margin of safety gives confidence to the organisation. A sudden drop in volume will not affect the profit so much. On the other hand, an undertaking with low margin of safety may wipe off the profit and turn into a loss with a drop in sales. Margin of safety (MoS) can be mathematically expressed using the marginal cost equations, namely, —

Margin of safety = Sales at selected activity – Break-even Sales

When profit = Sales – Total cost, and P/V ratio = Contribution / Sales

When M/S is expressed in ratio

we get, MoS = Sales at selected activity - B. E. S. Sales at selected activity.

### Angle Of Incidence:

This is the angle formed by the sales line and the total cost line at the break-even point. Angle of incidence is an indicator of profit earning capacity above the break-even point. A wider angle will indicate higher profitability, while a narrow angle will indicate very low profitability.

If margin of safety and angle of incidence are considered together, they will provide significant information to management regarding profit earning position of the undertaking.

A high margin of safety with a wider angle of incidence will indicate the most favourable condition of the business.

#### **Advantages of BEP :**

Such an analysis is useful to the management accountant in the following respects:

- (i) It helps him in forecasting the profit fairly accurately.
- (ii) It is helpful in setting up flexible budgets, since on the basis of this relationship, he can ascertain the costs, sales and profits at different levels of activity.
- (iii) It also assists him in performance evaluation for purposes of management control.
- (iv) It helps in formulating price policy by projecting the effect, which different price structures will have on cost and profits.
- (v) It helps in determining the amount of overhead cost to be charged at various levels of operations, since overhead rates are generally pre-determined on the basis of a selected volume of production.

#### **Limitations of BEP :**

1. Break-even analysis is only a supply-side (i.e., costs only) analysis, as it tells you nothing about what sales are actually likely to be for the product at these various prices.
2. It assumes that fixed costs (FC) are constant. Although this is true in the short run, an increase in the scale of production is likely to cause fixed costs to rise.
3. It assumes average variable costs are constant per unit of output, at least in the range of likely quantities of sales. (i.e., linearity).

## **Commercial Banks**

Commercial Banks are those profit seeking institutions which accept deposits from general public and advance money to individuals like household, entrepreneurs, businessmen etc. with the prime objective of earning profit in the form of interest, commission etc. Examples of commercial banks – ICICI Bank, State Bank of India, Axis Bank, and HDFC Bank

### **Functions -**

The main functions of commercial banks are accepting deposits from the public and advancing them loans.

However, besides these functions there are many other functions which these banks perform. All these functions can be divided under the following heads:

1. Accepting deposits
2. Giving loans
3. Overdraft
4. Discounting of Bills of Exchange
5. Investment of Funds
6. Agency Functions
7. Miscellaneous Functions

### 1. **Accepting Deposits:**

The most important function of commercial banks is to accept deposits from the public. Various sections of society, according to their needs and economic condition, deposit their savings with the banks.

For example, fixed and low income group people deposit their savings in small amounts from the points of view of security, income and saving promotion. On the other hand, traders and businessmen deposit their savings in the banks for the convenience of payment.

Therefore, keeping the needs and interests of various sections of society, banks formulate various deposit schemes. Generally, there are four types of deposits which are as follows:

#### (i) **Current Deposits:**

The depositors of such deposits can withdraw and deposit money whenever they desire. Since banks have to keep the deposited amount of such accounts in cash always, they carry either no interest or very low rate of interest. These deposits are called as Demand Deposits because these can be demanded or withdrawn by the depositors at any time they want.

Such deposit accounts are highly useful for traders and big business firms because they have to make payments and accept payments many times in a day.

#### (ii) **Fixed Deposits (Term deposits)**

These are the deposits which are deposited for a definite period of time. This period is generally not less than one year and, therefore, these are called as long term deposits. These deposits cannot be withdrawn before the expiry of the stipulated time and, therefore, these are also called as term deposits.

These deposits generally carry a higher rate of interest because banks can use these deposits for a definite time without having the fear of being withdrawn.

**(iii) Saving Deposits:**

In such deposits, money upto a certain limit can be deposited and withdrawn once or twice in a week. On such deposits, the rate of interest is very less. As is evident from the name of such deposits their main objective is to mobilise small savings in the form of deposits. These deposits are generally done by salaried people and the people who have fixed and less income.

**(iv) Recurring deposits:**

In such deposits money is deposited for a fixed period in monthly installments basis and is repaid to the depositors along with the interest on maturity.

## **2. Giving Loans:**

The second important function of commercial banks is to advance loans to its customers. Banks charge interest from the borrowers and this is the main source of their income.

Banks advance loans not only on the basis of the deposits of the public rather they also advance loans on the basis of depositing the money in the accounts of borrowers. In other words, they create loans out of deposits and deposits out of loans. This is called as credit creation by commercial banks.

Modern banks give mostly secured loans for productive purposes. In other words, at the time of advancing loans, they demand proper security or collateral. Generally, the value of security or collateral is equal to the amount of loan. This is done mainly with a view to recover the loan money by selling the security in the event of non-refund of the loan.

At times, banks give loan on the basis of personal security also. Therefore, such loans are called as unsecured loan. Banks generally give following types of loans and advances:

**(i) Cash Credit:**

In this type of credit scheme, banks advance loans to its customers on the basis of bonds, inventories and other approved securities. Under this scheme, banks enter into an agreement with its customers to which money can be withdrawn many times during a year. Under this set up banks open accounts of their customers and deposit the loan money. With this type of loan, credit is created.

(iii) **Demand loans:**

These are such loans that can be recalled on demand by the banks. The entire loan amount is paid in lump sum by crediting it to the loan account of the borrower, and thus entire loan becomes chargeable to interest with immediate effect.

(iv) **Short-term loan:**

These loans may be given as personal loans, loans to finance working capital or as priority sector advances. These are made against some security and entire loan amount is transferred to the loan account of the borrower.

**3. Over-Draft:**

Banks advance loans to its customer's upto a certain amount through over-drafts, if there are no deposits in the current account. For this banks demand a security from the customers and charge very high rate of interest.

**4. Discounting of Bills of Exchange:**

This is the most prevalent and important method of advancing loans to the traders for short-term purposes. Under this system, banks advance loans to the traders and business firms by discounting their bills. In this way, businessmen get loans on the basis of their bills of exchange before the time of their maturity.

**5. Investment of Funds:**

The banks invest their surplus funds in three types of securities—Government securities, other approved securities and other securities. Government securities include both, central and state governments, such as treasury bills, national savings certificate etc.

Other securities include securities of state associated bodies like electricity boards, housing boards, debentures of Land Development Banks units of UTI, shares of Regional Rural banks etc.

**6. Agency Functions:**

Banks function in the form of agents and representatives of their customers. Customers give their consent for performing such functions. The important functions of these types are as follows:

- (i) Banks collect cheques, drafts, bills of exchange and dividends of the shares for their customers.
- (ii) Banks make payment for their clients and at times accept the bills of exchange: of their customers for which payment is made at the fixed time.
- (iii) Banks pay insurance premium of their customers. Besides this, they also deposit loan installments, income-tax, interest etc. as per directions.
- (iv) Banks purchase and sell securities, shares and debentures on behalf of their customers.
- (v) Banks arrange to send money from one place to another for the convenience of their customers.

#### **7. Miscellaneous Functions:**

Besides the functions mentioned above, banks perform many other functions of general utility which are as follows:

- (i) Banks make arrangement of lockers for the safe custody of valuable assets of their customers such as gold, silver, legal documents etc.
- (ii) Banks give reference for their customers.
- (iii) Banks collect necessary and useful statistics relating to trade and industry.
- (iv) Banks facilitating foreign trade, banks undertake to sell and purchase foreign exchange.
- (v) Banks advise their clients relating to investment decisions as specialist
- (vi) Banks does the under-writing of shares and debentures also.
- (vii) Banks issue letters of credit.
- (viii) During natural calamities, banks are highly useful in mobilizing funds and donations.
- (ix) Banks provide loans for consumer durables like Car, Air-conditioner, and Fridge etc.

### **Types of Commercial Banks**

Commercial Banks in India are broadly categorized into Scheduled Commercial Banks and Unscheduled Commercial Banks. The Scheduled Commercial Banks have been listed under the Second Schedule of the Reserve Bank of India Act, 1934. The





- ABN Amro Bank                      Citibank                      AB Bank
- DBS Bank                              JSC VTB Bank
- Abu Dhabi Commercial Bank
- American Express Banking Corporation
- Antwerp Diamond Bank
- Bank International Indonesia
- Bank of America

**Other Scheduled Commercial Banks:**

- Axis Bank                              Bank of Rajasthan                      Catholic Syrian Bank
- City Union Bank                      Development Credit                      Federal Bank
- HDFC Bank                              ICICI Bank                              IndusInd Bank ING
- Vysya Bank                              Jammu & Kashmir Bank                      Yes Bank
- Karnataka Bank                      Kotak Mahindra Bank
- SBI Commercial & International Bank

**CENTRAL BANK OF INDIA**

**Meaning of Central Bank:**

It can be defined as the bank which stands as the leader of the money market .In our pyramidal financial structure, the central bank sits at the top.

A central bank is the apex monetary institution which supervises, regulates controls and develops the monetary and finance of the country. It manages the economy in the interest of general public welfare, but not maximization of profit.

Samuelson defines central bank "...as a bank of bankers. Its duty is to control the monetary base and through control of this 'high-powered money' to control the community's supply of money."

Indian government entrust all the important functions of a central bank to the RBI it was established in the year 1<sup>st</sup> April 1935.

**Main Functions**

**1. Monetary Authority :**

- Central bank formulates, implements & supervises the monetary policy of the country to maintain price stability & ensure adequate flow of credit.
- Central Bank is the controller of currencies.

**2. Regulator & Supervisor of the financial system :**

- Provides broad parameters for banking operations within which the country's banking & financial system functions.
- For supervising financial system, Central Bank formed the Board of Financial Supervision (BFS) in 1994. BFS mainly supervises commercial banks, FIs & NBFC

**3. Monetary Authority :**

- Central bank formulates, implements & supervises the monetary policy of the country to maintain price stability & ensure adequate flow of credit.
- Central Bank is the controller of currencies.

**4. Regulator & Supervisor of the financial system :**

- Provides broad parameters for banking operations within which the country's banking & financial system functions.
- For supervising financial system, Central Bank formed the Board of Financial Supervision (BFS) in 1994. BFS mainly supervises commercial banks, FIs & NBFC

**5. Managing Foreign Exchange :**

- Manages the foreign exchange of the country i.e. maintains the exchange rate of Rupee against other currencies.
- Central Bank also acts as the custodian of India's reserve of international currencies.
- Aim is to facilitate external trade & payments and promote orderly development & maintenance.

**6. Issuer of currency :**

- Under section 22 of the Central Bank Act, the bank has the sole right to issue bank notes of all denominations.
- Issues & exchanges or destroys currency & coins not fit for circulation.
- Central Bank has a separate Issue Dept. which is entrusted with the issue of currency notes

**7. Banker to government :**

- Acts as a government banker, agent & adviser for the central bank as well as for all state government. (except Jammu & Kashmir)
- Central Bank has to keep cash balances of the govt. as deposits, receive and make payments on behalf of the govt.

**8. banker's bank & lender of last resorts :**

- All scheduled banks have to maintain cash reserves i.e CRR equal to 3% of their aggregate deposit liabilities.
- The schedule banks can borrow money from Central Bank on the basis of the eligible securities in times of need & urgency.

#### 9. Promotional functions :

- Central Bank has directly or indirectly set up financial institutions like Deposit Insurance Corporation, UTI, IDBI, Agricultural Refinance Corporation of India, Co-operative credit movements, etc.
- This was with a view of promoting saving habits, eliminating money lenders, mobilizing savings, providing

## Inflation

Brooman defines it as "a continuing increase in the general price level. different names have been given to inflation depending upon the rate of rise in prices.

### 1. Creeping Inflation:

When the rise in prices is very slow like that of a snail or creeper, it is called creeping inflation. In terms of speed, a sustained rise in prices of annual increase of less than 3 per cent per annum is characterised as creeping inflation. Such an increase in prices is regarded safe and essential for economic growth.

### 2. Walking or Trotting Inflation:

the rate of rise in prices is in the intermediate range of 3 to 6 per cent per annum or less than 10 per cent. Inflation at this rate is a warning signal for the government to control it before it turns into running inflation.

### 3. Running Inflation:

When prices rise rapidly like the running of a horse at a rate or speed of 10 to 20 per cent per annum, it is called running inflation. Such an inflation affects the poor and middle classes adversely. Its control requires strong monetary and fiscal measures, otherwise it leads to hyperinflation.

### 4. Hyperinflation:

When prices rise very fast at double or triple digit rates from more than 20 to 100 per cent per annum or more, it is usually called runaway or galloping inflation. In reality, hyperinflation is a situation when the rate of inflation becomes immeasurable and absolutely uncontrollable. Prices rise many times every day. Such a situation brings a total collapse of monetary system because of the continuous fall in the purchasing power of money.

#### **5. Semi-Inflation:**

According to Keynes, so long as there are unemployed resources, the general price level will not rise as output increases. But a large increase in aggregate expenditure will face shortages of supplies of some factors which may not be substitutable. This may lead to increase in costs, and prices start rising. This is known as semi-inflation or bottleneck inflation because of the bottlenecks in supplies of some factors.

#### **6. True Inflation:**

According to Keynes, when the economy reaches the level of full employment, any increase in aggregate expenditure will raise the price level in the same proportion. This is because it is not possible to increase the supply of factors of production and hence of output after the level of full employment. This is called true inflation.

#### **7. Open Inflation:**

Inflation is open when "markets for goods or factors of production are allowed to function freely, setting prices of goods and factors without normal interference by the authorities. Thus open inflation is the result of the uninterrupted operation of the market mechanism. Increase in demand and shortage of supplies persist which tend to lead to open inflation. Unchecked open inflation ultimately leads to hyperinflation.

#### **8. Suppressed Inflation:**

When the government imposes physical and monetary controls to check open inflation, it is known as repressed or suppressed inflation. The market mechanism is not

allowed to function normally by the use of licensing, price controls and rationing in order to suppress extensive rise in prices.

### 9. Stagflation:

Stagflation is a situation when recession is accompanied by a high rate of inflation. It is, therefore, also called inflationary recession.

### 10. Sectoral Inflation:

Sectoral inflation arises initially out of excess demand in particular industries. But it leads to a general price rise because prices do not fall in the deficient demand sectors.

### 11. Reflation:

Is a situation when prices are raised deliberately in order to encourage economic activity. When there is depression and prices fall abnormally low, than the monetary authority adopts measures to put more money in circulation so that prices rise. This is called reflation.

Different type of inflation on the basis of causes

- A. Demand-Pull or excess demand inflation.
- B. Cost-push inflation

#### A. Demand-Pull or excess demand inflation.

Inflation is caused when the aggregate demand exceeds the aggregate supply of goods and services. We analyse the on the basis of factor affecting increasing demand and factors decreasing supply.

#### Factors Affecting Demand:

Inflation is caused by increase in the aggregate demand.

They point towards the following factors which raise it.

#### 1. Increase in Money Supply:

Inflation is caused by an increase in the supply of money which leads to increase in aggregate demand. The higher the growth rate of the nominal money supply, the higher is the rate of inflation. This view is realistic because all advanced countries are faced with high levels of unemployment and high rates of inflation.

## **2. Increase in Disposable Income:**

When the disposable income of the people increases, it raises their demand for goods and services. Disposable income may increase with the rise in national income or reduction in taxes or reduction in the saving of the people.

## **3. Increase in Public Expenditure:**

Government activities have been expanding much with the result that government expenditure has also been increasing at a phenomenal rate, thereby raising aggregate demand for goods and services.

## **4. Increase in Consumer Spending:**

The demand for goods and services increases when consumer expenditure increases. Consumers may spend more due to conspicuous consumption or demonstration effect. They may also spend more when they are given credit facilities to buy goods on hire-purchase and instalment basis.

## **5. Cheap Monetary Policy:**

Cheap monetary policy or the policy of credit expansion also leads to increase in the money supply which raises the demand for goods and services in the economy. When credit expands, it raises the money income of the borrowers which, in turn, raises aggregate demand relative to supply, thereby leading to inflation. This is also known as credit-induced inflation.

## **6. Deficit Financing:**

In order to meet its mounting expenses, the government resorts to deficit financing by borrowing from the public and even by printing more notes. This raises aggregate demand in relation to aggregate supply, thereby leading to inflationary rise in prices. This is also known as deficit-induced inflation.

#### **7. Expansion of the Private Sector:**

The expansion of the private sector also tends to raise the aggregate demand. For huge investments increase employment and income, thereby creating more demand for goods and services. But it takes time for the output to enter the market.

#### **8. Black Money:**

The existence of black money in all countries due to corruption, tax evasion etc. increases the aggregate demand. People spend such unearned money extravagantly, thereby creating unnecessary demand for commodities. This tends to raise the price level further.

#### **9. Repayment of Public Debt:**

Whenever the government repays its past internal debt to the public, it leads to increase in the money supply with the public. This tends to raise the aggregate demand for goods and services.

#### **10. Increase in Exports:**

When the demand for domestically produced goods increases in foreign countries, this raises the earnings of industries producing export commodities. These, in turn, create more demand for goods and services within the economy.

#### **Factors Affecting Supply:**

There are also certain factors which operate on the opposite side and tend to reduce the aggregate supply.

Some of the factors are as follows:

##### **1. Shortage of Factors of Production:**



One of the important causes affecting the supplies of goods is the shortage of such factors as labour, raw materials, power supply, capital, etc. They lead to excess capacity and reduction in industrial production.

## **2. Industrial Disputes:**

In countries where trade unions are powerful, they also help in curtailing production. Trade unions resort to strikes and if they happen to be unreasonable from the employers' viewpoint and are prolonged, they force the employers to declare lock-outs. In both cases, industrial production falls, thereby reducing supplies of goods. If the unions succeed in raising money wages of their members to a very high level than the productivity of labour, this also tends to reduce production and supplies of goods.

## **3. Natural Calamities:**

Drought or floods is a factor which adversely affects the supplies of agricultural products. The latter, in turn, create shortages of food products and raw materials, thereby helping inflationary pressures.

## **4. Artificial Scarcities:**

Artificial scarcities are created by hoarders and speculators who indulge in black marketing. Thus they are instrumental in reducing supplies of goods and raising their prices.

## **5. Increase in Exports:**

When the country produces more goods for export than for domestic consumption, this creates shortages of goods in the domestic market. This leads to inflation in the economy.

## **6. Lop-sided Production:**

If the stress is on the production of comforts, luxuries, or basic products to the neglect of essential consumer goods in the country, this creates shortages of consumer goods. This again causes inflation.

## 7. Law of Diminishing Returns:

If industries in the country are using old machines and outmoded methods of production, the law of diminishing returns operates. This raises cost per unit of production, thereby raising the prices of products.

## 8. International Factors:

In modern times, inflation is a worldwide phenomenon. When prices rise in major industrial countries, their effects spread to almost all countries with which they have trade relations. Often the rise in the price of a basic raw material like petrol in the international market leads to rise in the price of all related commodities in a country.

### B. Cost-push inflation

Cost-push inflation is caused by wage increases enforced by unions and profit increases by employers. Cost-push inflation is caused by wage-push and profit-push to prices for the following reasons:

#### 1. Rise in Wages:

The basis cause of cost-push inflation is the rise in money wages more rapidly than the productivity of labour. In advanced countries, trade unions are very powerful. They press employers to grant wage increases considerably in excess of increases in the productivity of labour, thereby raising the cost of production of commodities. Employers, in turn, raise prices of their products.

#### 2. Sectoral Rise in Prices:

Again, a few sectors of the economy may be affected by money wage increases and prices of their products may be rising. In many cases, their production such as steel, raw materials, etc. are used as inputs for the production of commodities in other sectors. As a result, the production cost of other sectors will rise and thereby push up the prices of their products.

#### 3. Rise in Prices of Imported Raw Materials:

An increase in the prices of imported raw materials may lead to cost-push inflation. Thus a continuous rise in the prices of raw materials tends to set off a cost-price-wage spiral.

#### **4. Profit-Push Inflation:**

Oligopolist and monopolist firms raise the prices of their products to offset the rise in labour and production costs so as to earn higher profits. There being imperfect competition in the case of such firms, they are able to “administer prices” of their products.

To the extent such a process is wide-spread profit-push inflation will result.” Profit-push inflation is, therefore, also called administered-price theory of inflation or price-push inflation or sellers’ inflation or market-power inflation.

#### **Measures to Control Inflation**

The various methods are usually grouped under three heads: Monetary measures, fiscal measures and other measures.

##### **1. Monetary Measures:**

Monetary measures aim at reducing money incomes.

##### **(a) Credit Control:**

One of the important monetary measures is monetary policy. The central bank of the country adopts a number of methods to control the quantity and quality of credit. For this purpose, it raises the bank rates, sells securities in the open market, raises the reserved ratio, and adopts a number of selective credit control measures, such as raising margin requirements and regulating consumer credit.

Monetary policy may not be effective in controlling inflation, if inflation is due to cost-push factors. Monetary policy can only be helpful in controlling inflation due to demand-pull factors.

##### **(b) Demonetisation of Currency:**

However, one of the monetary measures is to demonetise currency of higher denominations. Such a measure is usually adopted when there is abundance of black money in the country.

**(c) Issue of New Currency:**

The most extreme monetary measure is the issue of new currency in place of the old currency. Under this system, one new note is exchanged for a number of notes of the old currency. The value of bank deposits is also fixed accordingly. Such a measure is adopted when there is an excessive issue of notes and there is hyperinflation in the country. It is a very effective measure. But is inequitable for it hurts the small depositors the most.

**2. Fiscal Measures:**

Monetary policy alone is incapable of controlling inflation. It should, therefore, be supplemented by fiscal measures. Fiscal measures are highly effective for controlling government expenditure, personal consumption expenditure, and private and public investment.

**The principal fiscal measures are the following:**

**(a) Reduction in Unnecessary Expenditure:**

The government should reduce unnecessary expenditure on non-development activities in order to curb inflation. This will also put a check on private expenditure which is dependent upon government demand for goods and services. But it is not easy to cut government expenditure. Though economy measures are always welcome but it becomes difficult to distinguish between essential and non-essential expenditure. Therefore, this measure should be supplemented by taxation.

**(b) Increase in Taxes:**

To cut personal consumption expenditure, the rates of personal, corporate and commodity taxes should be raised and even new taxes should be levied, but the rates

of taxes should not be so high as to discourage saving, investment and production. Rather, the tax system should provide larger incentives to those who save, invest and produce more.

Further, to bring more revenue into the tax-net, the government should penalise the tax evaders by imposing heavy fines. Such measures are bound to be effective in controlling inflation. To increase the supply of goods within the country, the government should reduce import duties and increase export duties.

#### **(c) Increase in Savings:**

Another measure is to increase savings on the part of the people. This will tend to reduce disposable income with the people, and hence personal consumption expenditure. But due to the rising cost of living, people are not in a position to save much voluntarily. Keynes, therefore, advocated compulsory savings or what he called 'deferred payment' where the saver gets his money back after some years.

For this purpose, the government should float public loans carrying high rates of interest, start saving schemes with prize money, or lottery for long periods, etc. It should also introduce compulsory provident fund, provident fund-cum-pension schemes, etc. compulsorily. All such measures to increase savings are likely to be effective in controlling inflation.

#### **(d) Surplus Budgets:**

An important measure is to adopt anti-inflationary budgetary policy. For this purpose, the government should give up deficit financing and instead have surplus budgets. It means collecting more in revenues and spending less.

#### **(e) Public Debt:**

At the same time, it should stop repayment of public debt and postpone it to some future date till inflationary pressures are controlled within the economy. Instead, the government should borrow more to reduce money supply with the public.

Like the monetary measures, fiscal measures alone cannot help in controlling inflation. They should be supplemented by monetary, non-monetary and non-fiscal measures.

### **3. Other Measures:**

**The other types of measures are those which aim at increasing aggregate supply and reducing aggregate demand directly:**

#### **(a) To Increase Production:**

**The following measures should be adopted to increase production:**

(i) One of the foremost measures to control inflation is to increase the production of essential consumer goods like food, clothing, kerosene oil, sugar, vegetable oils, etc.

(ii) If there is need, raw materials for such products may be imported on preferential basis to increase the production of essential commodities.

(iii) Efforts should also be made to increase productivity. For this purpose, industrial peace should be maintained through agreements with trade unions, binding them not to resort to strikes for some time.

(iv) The policy of rationalisation of industries should be adopted as a long-term measure. Rationalisation increases productivity and production of industries through the use of brain, brawn and bullion.

(v) All possible help in the form of latest technology, raw materials, financial help, subsidies, etc. should be provided to different consumer goods sectors to increase production.

#### **(b) Rational Wage Policy:**

Another important measure is to adopt a rational wage and income policy. Under hyperinflation, there is a wage-price spiral. To control this, the government should freeze wages, incomes, profits, dividends, bonus, etc. But such a drastic measure can only be adopted for a short period and by antagonising both workers and industrialists. Therefore, the best course is to link increase in wages to increase in productivity. This will have a dual effect. It will control wages and at the same time increase productivity, and hence increase production of goods in the economy.

**(c) Price Control:**

Price control and rationing is another measure of direct control to check inflation. Price control means fixing an upper limit for the prices of essential consumer goods. They are the maximum prices fixed by law and anybody charging more than these prices is punished by law. But it is difficult to administer price control.

**(d) Rationing:**

Rationing aims at distributing consumption of scarce goods so as to make them available to a large number of consumers. It is applied to essential consumer goods such as wheat, rice, sugar, kerosene oil, etc. It is meant to stabilise the prices of necessities and assure distributive justice. But it is very inconvenient for consumers because it leads to queues, artificial shortages, corruption and black marketing. Keynes did not favour rationing for it "involves a great deal of waste, both of resources and of employment."

**Conclusion:**

From the various monetary, fiscal and other measures discussed above, it becomes clear that to control inflation, the government should adopt all measures simultaneously. Inflation is like a hydra-headed monster which should be fought by using all the weapons at the command of the government

## National income

National income is the final outcome of all economic activities of a nation valued in terms of money.

**Economic activities** - it includes all human activities which create goods and services that can be valued at market price. ( e.g- production by farmers production by firms in the industrial sector, production of goods and services by the government enterprises, and services produced by business intermediaries (wholesalers and retailers), banks and other financial organizations, universities, colleges and hospitals,)

**Non-economic activities** - are those which produce goods and services that do not have any economic value. Non-economic activities include spiritual, psychological, social and political services.

Economic activities generate a large number of goods and services, and make net addition to the national stock of capital. These together constitute the national income of a 'closed economy'—an economy

We have defined national income from the angle of **product flows**. The same can be defined in terms of **money flows**.

While economic activities generate flow of goods and services, on the one hand, they also generate money flows, on the other, in the form of payments, wages, interest, rent, profits, and earnings of self-employed called factor earning) Thus,

National income may also be obtained by adding the factor earnings and adjusting the sum for indirect taxes and subsidies. The national income thus obtained is known as **national income at factor cost**. It is related to money income flows.

## MEASURES OF NATIONAL INCOME *Concept and Measurement*

### 1. Gross National Product (*GNP*)

*GNP* is the most important and widely used measure of national income. It is the most comprehensive measure of the nation's productive activities.

*The GNP is defined as the value of all final goods and services produced during a specific period, usually one year, plus incomes earned abroad by the nationals minus incomes earned locally by the foreigners.*

The *GNP* is identical to the concept of gross national income (*GNI*). Thus,  $GNP = GNI$ .

The difference between the two is that *GNP* is estimated on the basis of product-flows, the *GNI* is estimated on the basis of money income flows, (*i.e.*, wages, profits, rent, interest, etc.).

### 2. Gross Domestic Product (*GDP*)



The Gross Domestic Product (*GDP*) is defined as the market value of all final goods and services produced in the domestic economy during a period of one year, *plus* income earned locally by the foreigners *minus* incomes earned abroad by the nationals.

The concept of *GDP* is similar to that of *GNP*. In case of *GNP* the incomes earned by the nationals in foreign countries are added and incomes earned locally by the foreigners are deducted from the market value of domestically produced goods and services.

In case of *GDP*, the process is reverse – incomes earned locally by foreigners are added and incomes earned abroad by the nationals are deducted from the total value of domestically produced goods and services.

### 3. Net National Product (*NNP*)

*NNP* is defined as *GNP less* depreciation,

*i.e.*,  $NNP = GNP - \text{Depreciation}$

'Depreciation' is the term used to denote the worn-out or used up capital.

The *NNP*, as defined above, gives the measure of net output available for consumption and investment by the society (including consumers, producers and the government). *NNP* is the real measure of the national income.  $NNP = NNI$  (net national income). In other words, *NNP* is the same as the national income at *factor cost*. It should be noted that *NNP* is measured at market prices including direct taxes. Indirect taxes are, however, not a point of actual cost of production.

Therefore, to obtain real national income, indirect taxes are deducted from the *NNP*. Thus,  $NNP - \text{indirect taxes} = \text{National Income}$ .

## 4. National Income: Some Accounting Relationships

### (a) Accounting Identities' at Market Price

$GNP \equiv GNI$  (Gross National Income)

$GDP \equiv GNP \text{ less Net Income from Abroad}$

$NNP \equiv GNP \text{ less Depreciation}$

$NDP$  (Net Domestic Product)  $\equiv NNP \text{ less net income from abroad}$

### (b) Some Accounting Identities at Factor Cost

$GNP \text{ at factor cost} \equiv GNP \text{ at market price less net indirect taxes}$

$NNP \text{ at factor cost} \equiv NNP \text{ at market price less net indirect taxes}$

$NDP \text{ at factor cost} \equiv NNP \text{ at market price less net income from abroad}$

$NDP \text{ at factor cost} \equiv NDP \text{ at market price less net indirect taxes}$

$NDP \text{ at factor cost} \equiv GDP \text{ at market price less Depreciation}$

## Methods Of Measuring National Income

For measuring national income, the economy through which people participate in economic activities, earn their livelihood, produce goods and services and share the national products is viewed from three different angles.

- (1) The national economy is considered as an *aggregate of producing units* combining different sectors such as agriculture, mining, manufacturing, trade and commerce, etc.
- (2) The whole national economy is viewed as a *combination of individuals and households owning different kinds of factors of production* which they use themselves or sell factor-services to make their livelihood.
- (3) The national economy may also be viewed as a collection of consuming, saving and investing units (individuals, households and government).

Following these concept of a national economy, national income may be measured by three different corresponding methods:

- (1) *Net product method*—when the entire national economy is considered as an aggregate of producing units;
  - (2) *Factor-income method*—when national economy is considered as combination of factor-owners and users;
  - (3) *Expenditure method*—when national economy is viewed as a collection of spending units.
- The procedures which are followed in measuring the national income in a *closed economy*—an economy which has no economic transactions with the rest of the world—are briefly described here. The measurement of national income in an open economy and adjustment with regard to income from abroad will be discussed subsequently.

### 1. Net Output or Value-Added Method (value added method)

The net output method is also called the value added method. this method consists of three stages:

- (i) estimating the gross value of domestic output in the various branches of production;
- (ii) determining the cost of material and services used and also the depreciation of physical assets; and
- (iii) deducting these costs and depreciation from gross value to obtain the net value of domestic output...". The net value of domestic product thus obtained is often called the *value added* or *income product* which is equal to the sum of wages, salaries, supplementary labour incomes, interest, profits, and net rent paid or accrued. Let us now describe the stages (i) and (ii) in some detail.

**Measuring Gross Value.** For measuring the gross value of domestic product, output

is classified under various categories on the basis of the nature of activities from which they originate. The output classification varies from country to country depending on (i) the nature of domestic activities; (ii) their significance in aggregate economic activities, and (iii) availability of requisite data. For example, in the US, about seventy-one divisions and subdivisions are used to classify the national output; in Canada and the Netherlands, classification ranges from a dozen to a score; and in Russia, only half a dozen divisions are used. According to the CSO publication, fifteen sub-categories are currently used in India.

After the output is classified under the various categories, the value of gross output is computed in two alternative ways: (i) by multiplying the output of each category of sector by their respective market price and adding them together, or (ii) by collective data about the gross sales and changes in inventories from the account of the manufacturing enterprises and computing the value of GDP on the basis thereof. If there are gaps in data, some estimates are made thereof and gaps are filled.

***Estimating Cost of Production.*** The next step in estimating the net national product is to estimate the cost of production including depreciation. Estimating cost of production is, however, a relatively more complicated and difficult task because of nonavailability of adequate and requisite data. Much more difficult is the task of estimating depreciation since it involves both conceptual and statistical problems. For this reason, many countries adopt factor-income method for estimating their national income. However, countries adopting net-product method find some ways and means to calculate the deductible cost. The costs are estimated either in absolute terms (where input data are adequately available) or as an overall ratio of input to the total output. The general practice in estimating depreciation is to follow the usual business practice of depreciation accounting. Traditionally, depreciation is calculated at some percentage of capital, permissible under the tax-laws. In some estimates of national income, the estimators have deviated from the traditional practice and have instead estimated depreciation as some ratio of the current output of final goods.

Following a suitable method, deductible costs including depreciation are estimated for each sector. The cost estimates are then deducted from the sectoral gross output to obtain the net sectoral products. The net sectoral products are then added together. The total thus obtained is taken to be the measure of net national products or national income by net product method.

## 2. Factor-Income Method

This method is also known as *income method* and *factor-share method*. Under this method, the national income is calculated by adding up all the “incomes accruing to the basic factors of production used in producing the national product”. Factors of production are conventionally classified as land, labour, capital and organization.

Accordingly, the national income equals the sum of the corresponding factor earning.

Thus, National income = Rent + Wages + Interest + Profit

However, in a modern economy, it is conceptually very difficult to make a distinction between earnings from land and capital, on the one hand, and between the earnings from ordinary labour and entrepreneurial functions, on the other. For the purpose of estimating national income, therefore, factors of production are broadly grouped as labour and capital.

Accordingly, national income is supposed to originate from two primary factors, viz., labour and capital. In some activities, however, labour and capital are jointly supplied and it is difficult to separate the labour and capital contents from the total earnings of the supplier. Such incomes are termed as *mixed incomes*. Thus, the total factor-incomes are grouped under three categories: (i) labour incomes; (ii) capital incomes; and (iii) mixed incomes.

**Labour Incomes.** Labour incomes included in the national income have three components: (a) wages and salaries paid to the residents of the country including bonus and commission, and social security payments; (b) supplementary labour incomes including employer’s contribution to social security and employee’s welfare funds, and direct pension payments to retired employees<sup>2</sup>; (c) supplementary labour incomes in kind, e.g., free health and education, food and clothing, and accommodation, etc. Compensations in kind in the form of domestic servants and such other free-of-cost services provided to the employees are included in labour income. War bonuses, pensions, service grants are not included in labour income as they are regarded as ‘transfer payments’.

Certain other categories of income, e.g., incomes from incidental jobs, gratuities, tips etc., are ignored for lack of data.

**Capital Incomes.** According to Studenski, capital incomes include the following capital earnings:

- (a) dividends excluding inter-corporate dividends;
- (b) undistributed before-tax profits of corporations;
- (c) interest on bonds, mortgages, and saving deposits (excluding interests on war bonds, and on consumer-credit);
- (d) interest earned by insurance companies and credited to the insurance policy reserves;

- (e) net interest paid out by commercial banks;
- (f) net rents from land, buildings, etc., including imputed net rents on owneroccupied dwellings;
- (g) royalties; and
- (h) profits of government enterprises.

The data for the first two items are obtained mostly from the firms' accounts submitted for taxation purposes. But the definition of profit for national accounting purposes differs from that employed by taxation authorities. Some adjustments in the income tax data become, therefore, necessary.

The data adjustments generally pertain to (i) excessive allowance of depreciation made by the firms; (ii) elimination of capital gains and losses since these do not reflect the changes in current income; and (iii) elimination of under or over-valuation of inventories on book-value.

**Mixed Income.** Mixed incomes include earnings from (a) farming enterprises, (b) sole proprietorship (not included under profit or capital income); and (c) other professions, e.g., legal and medical practices, consultancy services, trading and transporting etc. This category also includes the incomes of those who earn their living through various sources as wages, rent on own property, interest on own capital, etc.

All the three kinds of incomes, viz., labour incomes, capital incomes and mixed incomes added together give the measure of national income by *factor-income method*.

### 3. Expenditure Method

The expenditure method, also known as *final product method*, measures national income at the final expenditure stages. In estimating the total national expenditure, any of the two following methods are followed:

**first**, all the money expenditures at market price are computed and added up together, and **second**, the value of all the products finally disposed of are computed and added up, to arrive at the total national expenditure.

The items of expenditure which are taken into account under the *first method* are (a) private consumption expenditure; (b) direct tax payments; (c) payments to the non-profitmaking institutions and charitable organizations like schools, hospitals, orphanages, etc.; and (d) private savings.

Under the *second method*, the following items are considered:

(a) private consumer goods and services; (b) private investment goods; (c) public goods and services; and (d) net investment abroad. The second method is more extensively

used because the data required in this method can be collected with greater ease and accuracy.

***Treatment of Net Income from Abroad.*** We have so far discussed methods of measuring national income of a 'closed economy'. But most economies are *open* in the sense that they carry out foreign trade in goods and services and financial transactions with the rest of the world. In the process, some nations get net income through foreign trade while some lose their income to foreigners. The net earnings or loss in foreign trade affects the national income. In measuring the national income, therefore, the net result of external transactions are adjusted to the total. Net incomes from abroad are added to, and net losses to the foreigners are deducted from the total national income arrived at through any of the above three methods.

Briefly, speaking, all exports of merchandise and of services like shipping, insurance, banking, tourism, and gifts are added to the national income. And, all the imports of the corresponding items are deducted from the value of national output to arrive at the approximate measure of national income. To this is added the net income from foreign investment. These adjustments for international transactions are based on the international balance of payments of the nations.

## Engineering Economics & Costing

### Module-III: (12 hours)

#### Time value of money

- Interest - Simple and compound, nominal and effective rate of interest,  
Cash flow diagrams, Principles of economic equivalence.

#### Evaluation of engineering projects-

Present worth method, Future worth method,  
Annual worth method,  
Internal rate of return method,  
Cost benefit analysis for public projects .

#### Depreciation-

Depreciation of capital asset,  
Causes of depreciation,  
Methods of calculating depreciation (Straight line method, Declining balance  
method),  
After tax comparison of project.

---

**Economics;** it is the study of how people and society choose to employ scarce resources that could have alternative uses in order to produce various commodities and to distribute them for consumption now or in the future among persons in society or groups.

Engg. Economics

#### Interest:-

It is the cost of using capital. Interest represents the earning power of money. It is a premium paid to compensate a lender for making a loan, risk of non-payment.

**Simple interest:-** (S.I) when interest earned is directly proportional to capital involved in loan or original principal for any length of time.

$$S.I = P i N$$

P = principal, i = rate of interest, N = number of periods.

Methods of calculating simple interest.

- 1) **Ordinary S.I.** = Here a year is divided into 12 equal months of each 30 days.
- 2) **Exact S.I.** = Here a year has the calendar number of days, i.e. 365 days.

Example = A person has borrowed with  $i=12\%$ , for first 3 month what is F, when  $P=10,000$

$$\text{Ordinary S.I} = 10,000 * 12 / 100 * 3 / 12 = 300$$

$$F = 10000 + 300 = 10300$$

Exact S.I = total number of days  $= (31+28+31) / 365 = 90 / 365$

$$\text{S.I} = P * I * (90 / 365)$$

$$= 10000 * 12 / 100 * 90 / 365$$

$$= 295.89$$

$$F = 10000 + 295.89 = 10295.89.$$

**Nominal interest** = When an interest rate is coated on annual basis i.e express as 'r'

**Compound interest** =

It includes charges for principal amount as well as for the accumulated interest

$$F = P (1 + i)^N \quad \text{Where } N = \text{number of years, } i = \text{interest rate.}$$

e.g-1

$$P = 1000, \quad N = 3 \text{ year, } i = 10\% \quad F = ?$$

	Principal	interest	future sum	
1 <sup>st</sup> year	1000	100	1100	
2 <sup>nd</sup> year	1100	110	1210	
3 <sup>rd</sup> year	1210	121	1331	F=1331

e.g-2

A person takes Rs 1000 from ram at a nominal interest rate of 12% compounded quarterly . what will be final amount he is going to return after one year.

$$F = P (1 + r/m)^{m*N}$$

$m$  = is compounding period , here  $m = 4$



$$F = 1000 \left(1 + \frac{0.12}{4}\right)^{4 \times 1}$$

$$F = \text{Rs } 1125.5$$

This means that a nominal interest rate of 12% compounded quarterly is equivalent to 12.55% on annual basis .

This 12.55% is called as effective interest rate.

### Effective interest rate – ( $i_{\text{eff}}$ )

It is the ratio of interest charged for 1 year to principal.

$$i_{\text{eff}} = \frac{F - P}{P} \quad (\text{or}) \quad i_{\text{eff}} = \left(1 + \frac{r}{m}\right)^m - 1$$

$$= (1125.50 - 1000) / 1000 = 12.55\% \quad (\text{Ans.})$$

### Continuous compounding – ( $i_{\infty}$ )

The ultimate limit for the number of compounding periods in one year . Here m approach to infinity as interest compounded moments by moments . the interest period are made very small .

$i_{\infty}$  = effective interest rate in continuous compounding.

$$i_{\infty} = \lim_{m \rightarrow \infty} \left(1 + \frac{r}{m}\right)^m - 1 = \lim_{m \rightarrow \infty} \left[\left(1 + \frac{r}{m}\right)^{m/r} - 1\right]^r$$

$$i_{\infty} = e^r - 1 \quad (\text{as, } \lim_{m \rightarrow \infty} \left[\left(1 + \frac{1}{r}\right)^r = e\right])$$

$$i_{\infty} = e^r - 1$$

### Compound Interest Factor

Cash flow is translated to a given time by determining either its present worth or its future worth.

The Present worth calculation convert a single future sum or as series of future values to an equivalent amount at an earlier date.

The future worth calculation converts values occurring at any time to an equivalent amount at a later date.

Equivalent values could be determined by calculating the compound amount of each sum for each period. This is a tedious work.

To avoid this tedious routine we may use or take helps of compound interest tables or compound interest factor

There are two basic types of factors

1. Single Payment Conversion.
2. Uniform Series Payment Conversion.

There are 6 compound interest factor.

- |                                   |   |                                    |
|-----------------------------------|---|------------------------------------|
| a) Compound amount factor.        | } | Single Payment Conversion.         |
| b) Present worth factor.          |   |                                    |
| c) Sinking fund Factor.           | } | Uniform Series Payment Conversion. |
| d) Series compound amount factor. |   |                                    |
| e) Capital recovery factor.       |   |                                    |
| f) Series present worth.          |   |                                    |

**Annuity** :- An uniform series of equal payments is called annuity.

An annuity characterized by

- i) Equal payments
- ii) Equal periods between the payments
- iii) The 1<sup>st</sup> payment occurring at the end of the 1<sup>st</sup> period.

Annuity factors are used to convert a series of payment to a single future or present sum and to translate single sums to a series of payments to a series of payments occurring at past as future.

### Conversion of Symbol

There are 7 basic interest factors for discrete compounding

(Name & notation for this factor suggested by the Engineering economy division of the American society for engineering education.)

Exp. – Compound amount factor (Find future worth of a single payment) and a notational form (i.e.  $F/p, i \%, N$ ) where functional symbol( $f/p$ ) represent the interest factor,  $i \%$  represent specific interest rate and  $N$  time period.

**Factor**

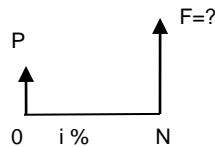
Factor	Symbol
Compound Amount	$(F/P, i \%, N)$
Present worth	$(P/F, i \%, N)$
Sinking Fund	$(A/F, i \%, N)$
Series compound factor	$(F/A, i \%, N)$
Capital recovery factor	$(A/P, i \%, N)$
Series present worth	$(P/A, i \%, N)$
Arithmetic gradient conversion	$(A/G, i \%, N)$

**Development of Interest Formula**

**1. Compound amount factor (Single Payment)**

To Find : "F"

at given P, given i, given N

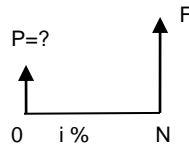


Numerical Formula =  $F = P(1 + i)^N = P(F/P, i, N)$

**2. Present Worth Factor  $F(P/F, i, N)$**

To Find : "P" = ?

at given F, given i, given N



numerical Formula =  $P = \frac{F}{(1+i)^N} = F(P/F, i, N)$

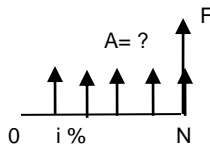
3. **Sinking Fund Factor (Uniform Series) (A/F, i %, N)**

A fund establish to accumulate a given future amount through the collection of uniform series of payment is sinking fund.

To Find : "A"

at given F, given i, given N

Symbol = (A/F, i %, N)



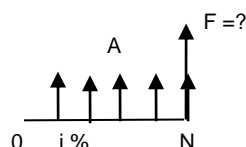
Numerical Formula =  $A = \frac{F[i] / ((1+i)^N - 1)}{1} = F(A/F, i, N)$

4. **Series compound amount factor (uniform series) (F/A, i %, N)**

To Find : "F"

at given A, given i, given N

Symbol = (F/A, i %, N)



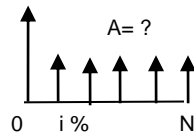
Numerical Formula =  $F = \boxed{A \left[ \frac{(1+i)^N - 1}{i} \right]} = \boxed{A (F/A, i, N)}$

**5. Capital recovery factor (uniform series) (A/P, i, N)**

To Find : "A"

at given P, given i, given N

Symbol = (A/P, i %, N)



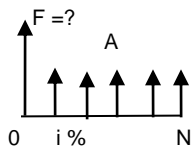
Numerical Formula =  $A = \boxed{P \left[ \frac{i(1+i)^N}{(1+i)^N - 1} \right]} = \boxed{P(A/P, i, N)}$

**6. Series present worth factor (uniform series)**

To Find : "P"

at given A, given i, given N

Symbol = (F/A, i %, N)



Numerical Formula =  $P = \boxed{A \left[ \frac{(1+i)^N - 1}{i(1+i)^N} \right]} = \boxed{A (P/A, i, N)}$

Exp – Present worth of the annuity composed of five annual payments of Rs. 1000 /- each invested at 8% compounded annually.

$P = ?, A = 1000, i = 8\%, N = 5$

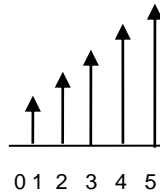
$P = A(P/A, i, N) = 1000(P/A, 8, 5) = 1000(3.992) = 3992.71$

7. **Arithmetic gradient conversion factor** (A/G, i, N)

When a series of payments follow the pattern of an arithmetic gradient (uniform increasing series) the increasing pattern can be converted to an uniform series with the help of Arithmetic gradient factor.

If a series of payment follows uniform increasing trend that can be evaluated by A. Calculating F or P for each individual payment and summing the result. OR

B. calculation time is reduced by converting the series to an equivalent unity of equal payments A and an Arithmetic gradient series increasing by G.



Formula (A/G, i, N)

To find =A

G = Given, N = given, i = given

where A' = Base payment

$$G \quad \boxed{A = A' \pm G(A/G, i, N)} = \text{Gradient factor}$$

Symbol =

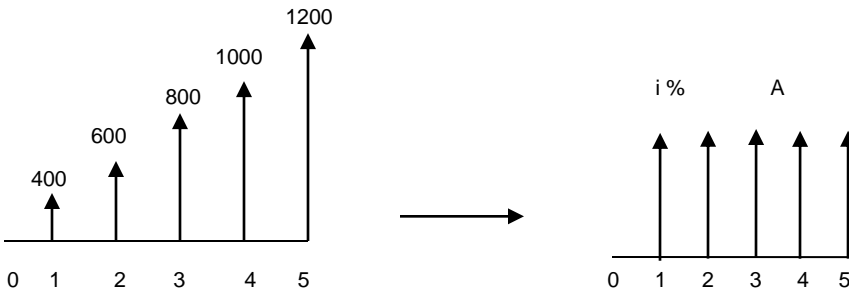
$$\text{Numerical Formula} = A = \boxed{A' + G \left[ \frac{1}{i} - \frac{N}{(1+i)^N - 1} \right]} = \boxed{A' + G(A/G, i, N)}$$

$$\text{Numerical Formula} = A = \boxed{A' - G \left[ \frac{1}{i} - \frac{N}{(1+i)^N - 1} \right]} = \boxed{A' - G(A/G, i, N)}$$

(+ve sign for increasing trend and -ve sign for decreasing trend)

**Qu-** what would be the annuity of a series of 5 year-end payments of 400,600,800, 1000,1200, at an interest rate of 10%?

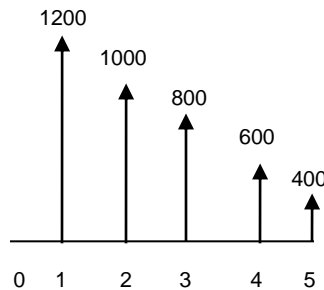
Given G = 200, A' = 400, i = 10% N = 5



$$\begin{aligned}
 A &= A' + G \left[ \frac{1}{i} - \frac{N}{(1+i)^N} - 1 \right] \quad \text{or} \quad A = A' + G(A/G, i, N) \\
 &= 400 + 200 \left[ \frac{1}{10\%} - \frac{5}{(1+10\%)^5} - 1 \right] \quad \quad \quad = 400 + 200 (A/G, 10, 5) \\
 &= 400 + 362 = 762 \text{ (Ans)} \quad \quad \quad = 400 + 362 = 762 \text{ (Ans)}
 \end{aligned}$$

Qu- what would be the annuity of a series of 5 year-end payments of 1200, 1000, 800, 600, 400, at an interest rate of 10%.? (decreasing trend)

Given  $G = 200$ ,  $A' = 1200$ ,  $i = 10\%$   $N = 5$



$$\begin{aligned}
 A &= A' - G \left[ \frac{1}{i} - \frac{N}{(1+i)^N} - 1 \right] \quad \text{or} \quad A = A' - G(A/G, i, N) \\
 &= 1200 - 200 \left[ \frac{1}{10\%} - \frac{5}{(1+10\%)^5} - 1 \right] \quad \quad \quad = 1200 - 200 (A/G, 10, 5) \\
 &= 1200 - 362 = 838 \text{ (ans)} \quad \quad \quad = 1200 + 362 = 838 \text{ (ans)}
 \end{aligned}$$

**Cash Flow Diagram :-**

Representing engineering data in graphical form cash flow diagrams are the tools to help the decision maker to understand and solve problems.

Cash flow diagram are simply graphical representation of income and outlay on a particular time frame.

The horizontal line (scale) represent time frame over which cash flow occur is divided into equal time period.

Individual outlay or received are represented by vertical axis (Line) Relative magnitude can be suggested by the height of lines.

Upward vertical line represented (incoming and receipt)

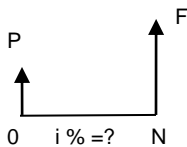
Downward vertical line represented (Outgoing & expenditure)

Whether the cash flow is positive and negative (Positive above time frame and negative below). Depends on whose view point is portrayed

### Single Cash Flow (Unknown interest rate) :

**Exp 1** – At what annual interest rate will Rs. 1000 invested today will be worth Rs. 2000 in 9 years

Given  $P = 1000$ ,  $F = 2000$ ,  $N = 9$  years.



$$F = P(F/P, i, N) \quad \text{or} \quad F/P = (F/P, i, N)$$

$$2000 / 1000 = (F/P, i, N) \quad \text{or} \quad 2 = (F/P, i, N)$$

$$i = 8\% \text{ (ans)}$$

**Exp 2** – At what annual interest rate will Rs. 1000 invested today be worth Rs. 2000 in 10 years

Given  $P = 1000$ ,  $F = 2000$ ,  $N = 10$  years.

$$F = P(F/P, i, N) \quad \text{or} \quad F/P = (F/P, i, N)$$

$$2000 / 1000 = (F/P, i, N) \quad \text{or} \quad 2 = (F/P, i, 10)$$

$$\text{at } i = 7\% \quad (F/P, 7, 10) = 1.96715$$

$$\text{at } i = 8\% \quad (F/P, 8, 10) = 2.15892$$

then by interpolation

$$i = 0.07 + 0.01 \left( \frac{2.00 - 1.96715}{2.15892 - 1.96715} \right) = 0.07 + 0.01 (0.03285 / 0.19177)$$



$$= \frac{2.15892 - 1.96715}{0.0717} = 7.2\% \text{ (Ans.)}$$

### Interpolation

$$\text{Required value} = \text{lower limit} + (\text{upper limit} - \text{lower limit}) \frac{(\text{desire value} - \text{values of lower limit})}{(\text{values of upper limit} - \text{values of lower limit})}$$

### Multiple Payment Cash flow

**Exp. 1** what is present worth of a series of 15 years and payment of Rs. 1000 each at  $i = 5\%$

Given  $A = 1000$ ,  $i = 5\%$ ,  $N = 15$ ,  $P = ?$

$$P = A (P/A, i, N) = 1000 (P/A, 5, 15) = 1000(10.37966) = 10379.66 \text{ (Ans.)}$$

**Exp. 2** Now is June 30, 2008. 3 payments of Rs. 500 each are to be receipt every 2 years, starting 2years from now and deposited in bank where they will earn interest at 7 % per year. How large will the bank account be on June 30 2016.

$$\begin{aligned} F &= P_1 (F/P, 7, 6) + P_2 (F/P, 7, 4) + P_3 (F/P, 7, 2) \\ &= 500 (F/P, 7, 6) + 500 (F/P, 7, 4) + 500 (F/P, 7, 2) \\ &= 500 (1.50073) + 500 (1.31080) + 500 (1.1449) \\ &= 500 (1.50073 + 1.31080 + 1.1449) \\ &= 500 + (3.95643) \\ &= 1978 \text{ (ans)} \end{aligned}$$

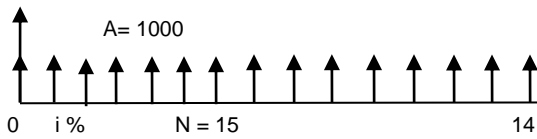
### Annuity due

A series of payment made at the beginning instead of the end of the each period is sometime referred to an annuity due.

Here the series of payment divided into 2 parts, where 1<sup>st</sup> payment translate separately and remaining payments feet for an ordinary annuity beginning at the time of the 1<sup>st</sup> payment

**Exp.** – what is the present worth of a series of 15 years end payments of Rs. 1000 each when the 1<sup>st</sup> payment is due today and interest grade is 5%

$$\text{Sol} = \text{Given } P = ? \quad A = 1000, N = 15 \quad i = 5\%$$



$$P = A + A(P/A, i, (N-1)) = 1000 + 1000(P/A, 5, (15-1)) = 1000 + 1000(P/A, 5, 14)$$

$$= 1000 + 1000(9.8986) = 1000 + 9899 = 10899 \text{ (Ans)}$$

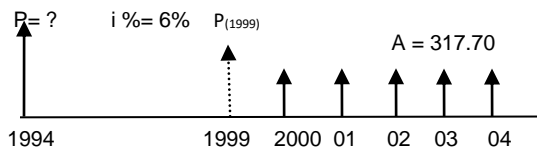
### Deferred Annuity

The uniform series of payments in which the 1<sup>st</sup> payment does not begin until some date later than the end of the 1<sup>st</sup> period is called deferred annuity.

The annuity also evaluate by dividing the time period into 2 Portion

1. One Part is the number of payment period and form an ordinary annuity.
2. Other Part is the number of periods.

Exp – With interest rate at 6% what is the worth on December 31st 1994 of a series of year and payments of Rs. 317.70 made from the years 2000 through 2004.



$$P_{(1999)} = A (P/A, i, N) \text{ (where } N = 5 \text{ and } i = 6\%)$$

$$= 317.70 (P/A, 6, 5)$$

now  $P_{(1999)}$  becomes the future value in calculating  $P(1994)$ .

$$P_{(1994)} = F(P/F, i, N) \quad \text{where } N = 5 \text{ (95th, 96th, 97th, 98th, 99th), } \quad i = 6 \%$$

$$= P_{(1999)} (P/F, i, N)$$

$$= 317.70(P/A, 6, 5) (P/F, i, N) = 317.70(4.21236) (0.74726)$$

$$= 1000 \text{ (Ans.)}$$

### **Present worth comparison**

Present worth of a future amount is its value discounted at the current rate of interest . OR

The present value of an amount expected at a future date is the sum of money , which must be invested today to get that amount given a rate of interest .

In Present worth comparison method the Present worth of all cash inflows (benefits)

Is compared against the Present worth of all cash outflows (costs) associated with an investment project.

### Condition for Present worth comparison

1. Cash flows are known : Transaction that occur now at time 0 should be accurate .
2. Cash flows are in constant value : the earning power of the money is assumed to remain unchanged during the study period
3. interest rate should known
4. comparison are made before tax cash flow
5. Comparison doesn't include consideration of the availability of funds to implement alternatives.

### Present worth equivalence :

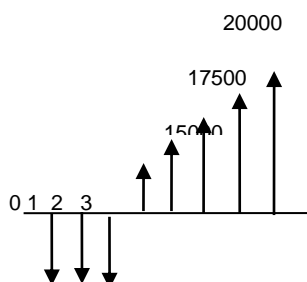
Determining the present worth equivalence of a series of future transactions, The purpose is to secure one figure (lump sum) that represent all the transactions.

The figure then be compared with a corresponding figure that represent transaction from a completing option .

A series of expenses that will occur in the future can be discounted to obtained its present worth and then a decision can made about whether an investment of the present worth amount should be made now to avoid the expenses.

e.g :

An investor can make 3 year end –of –payment of Rs15000 .which are expected to generate receipts of Rs 10000.at the end of year 4 .that will increase annually by Rs 25000,for following 4- years. If the investor can earn a rate of return of 10% on other 8-year investment is this alternative is attractive.



$PW = - 15000 (P/A, i, N) + PW \text{ of money earned}$

= If result is positive proposal is accepted.

$PW = - 15000 (P/A, 10, 3) + [A + G (A/G, i, N)] (P/A, i, 5) (P/F, 10, 3)$

= - 15000 (2.4865) + [ 10000 + 2500 (1.81013)] (3.79079)(0.75131)

= - 37300 + 41,369 = + 4066 (Accepted)

### **Net Present worth (NPW)**

The difference between the Present worth of cash inflows (benefits) associated with an investment project and Present worth of all cash out flows (costs) is Net Present worth (NPW).  $NPW = PW \text{ (benefits)} - PW \text{ (costs)}$

Select the alternatives which yields the larger positive Net Present worth (NPW). A negative Net Present worth (NPW) means that the alternative does not satisfy the rate of return requirement.

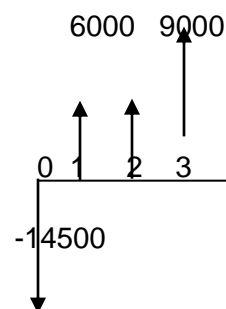
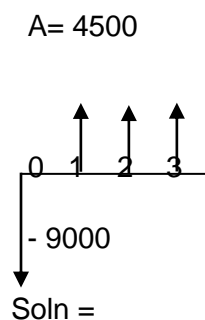
**Merits** It takes into account the time value of money. It considers the cash flows stream in entirety. The Net Present worth (NPW) determines whether or not the project is an acceptable investment.

This method involves

1. Determine the interest rate .
2. Estimate the service life of the project.
3. Estimate the cash inflows for each period over the service life.
4. Estimate the cash outflows for each period over the service life .
5. Calculate the net cash flow.
6. Find Present worth of each net cash flow add the PW figure . there sum is NPW denoted by  $PW_{(i)}$  .
7. if NPW is positive ( $NPW > 0$ ) i.e equivalent worth of cash inflows > equivalent worth of cash outflows , then project is acceptable .
8. if  $NPW < 0$  (project is rejected).
9. if  $NPW = 0$  (project is indifferent to the investment).

e.g- Two machines are available to perform a necessary function for three (3) years the initial cost for installment and subsequent annual saving from both the machines are given. the required interest rate is 8%.

MACHINE	0	1	2	3
A	- 9000	4500	4500	4500
B	-14500	6000	6000	8000



$$NPW(A) = -9000 + 4500(P/A, i, N) \quad NPW(B) = -14500 + 6000(P/A, i, N) + 9000(P/F, i, N)$$

$$= -9000 + 4500(P/A, 8\%, 3)$$

$$= -14500 + 6000(P/A, 8, 3)$$

$$+ 9000(P/F, 8, 3)$$

$$= -9000 + 4500(2.5771)$$

$$= -14500 + 6000(1.7832) + 9000(0.7938)$$

$$= 2569.5 \quad (\text{Accepted})$$

$$= 2550 \quad (\text{accepted})$$

### Comparison of assets that have unequal lives :

The assets which are compared with respect to present worth criterion are called coterminated assets . coterminated means that the lives of the involved assets end at the same time .

When the lives of assets being compared are unequal special procedure must followed.

e.g - A decision has to take between paying Rs 30/ for 3 year subscription to a magazine and paying Rs 40/ for 5 year subscription to the same publication can not decided by deducting 40-30 = 10 ,Because extra Rs 10 buy 2 more years of issues. The alternatives must compare on the basis of equivalent out come. So to take proper decision 2 methods are there.

1. common multiple method (repeated project method)
2. Study project method

**1. Common multiple method (repeated project method)**

Alternatives are Coterminated by selecting an analysis period that spans a common multiple of the lives of the involved assets.

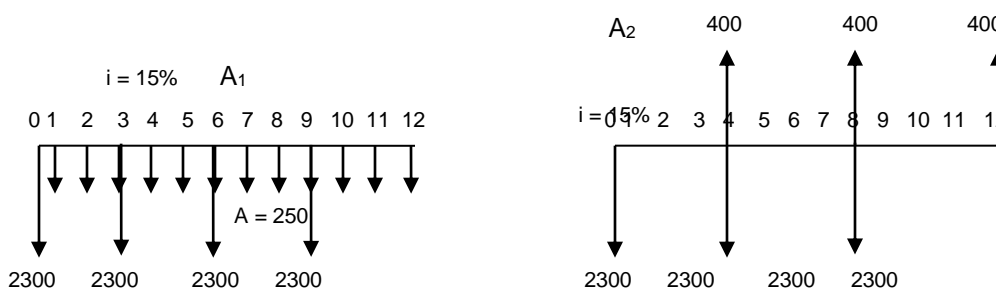
e.g If assets have lives of 2,3,4,6 years the L.C.M is 12 yr i.e assets with a life of 2 year would be replaced by 6 times during the analysis period.

The use of L.C.M. depends on the validity of the assumption that assets will be repeatedly replaced by successor having identical cost characteristics.

e.g - Assets  $A_1$  and  $A_2$  have the capability of satisfactorily performing a required function  $A_2$  has an initial cost of Rs 3200 / and an expected salvage value of Rs 400 / at the end of its 4 year life. asset  $A_1$  cost 900 / less initially with an economic life 1 year shorter than that of  $A_2$  , but has no salvage value . where as its annual operating cost exceed those of  $A_2$  by Rs 200 / . When rate of return is 15 % . state which alternative is preferred when compared by common multiple method (repeated project method)

**solution-**

( The repeated projected method is based on the assumption that assets will be replaced by identical models possessing same cost.). equivalent services results from comparing cost over a period divisible evenly by service lives of the alternatives , here L.C.M =12).



$$PW(A_1) = - 2300 - 2300(P/F, 15, 3) - 2300(P/F, 15, 6) - 2300(P/F, 15, 9) - 250 (P/A, 15, 12) = -$$

$$2300 - 2300(0.65752) - 2300(0.43233) - 2300(0.28422) - 250 (5.4206) = -6816 /-$$

$$PW(A_2) = - 3200 - 2800(P/F, 15, 4) - 2800(P/F, 15, 8) + 400(P/F, 15, 12) = -$$

$$3200 - 2800(0.57175) - 2800(0.32691) + 400(0.18691) = -5642 /-$$

As present worth advantage of  $A_2$  over  $A_1$   $(-5642 - (-6816)) = 1174$  for 12 years ,

so  $A_2$  is accepted .

## 2. Study project method :

This analysis based on a specified duration that corresponds to the length of a project or period of time of the assets. An appropriate study period reflects the length of the replacement circumstances. Some option to set those periods as the length of

- a) Shortest life of all competing alternatives.
- b) The know duration of required services.
- c) The time before better replacement becomes available.

It assumes that all assets will be disposed of at the end of the period. There fore the incomes that can be realized from the sale of an assets, which can be still provide useful services (salvage value).

Qu - Above example (consider 2-yr study period)

### Solution –

A 2 year study period for  $A_1$  and  $A_2$  indicates that the services required from either assets will be needed for only 2 years and will be disposed of at that time .

For  $S = 0$  (minimum value)

$$PW(A_1) = - 2300 - 250 (P/F, 15 , 2) = - 2300 - 250 (1.6257) = - 2707$$

$$PW (A_2) = -3200$$

( i.e  $A_1$  has lower present worth of costs for the 2 years service period , given the assumption of 0 salvage value.) .

The salvage value for  $A_2$  that would make  $PW(A_1) = PW (A_2)$

$$2707 = 3200 - S (P/F, 15 , 2)$$

$$S = (3200 - 2707) / (P/F, 15 , 2) = 493 / 0.75614 = 652$$

$A_2$  is preferred if resale value of  $A_2$  at the end of 2<sup>nd</sup> year is more than Rs 652/ at the same time.

### **Comparison of assets assumed to have infinite lives ( $\infty$ )**

For long live assets (like dam, railway ,tunnel) evaluation . It is essential to calculate capitalized cost .Capitalized cost is the sum of first cost and present worth of disbursement assume to last for ever .

Capitalized cost = First cost (P) + Present worth of Annual Disbursement

Capitalized cost calculate same way as in present worth comparison where  $N = \infty$

$$(P/A, i, N) = \frac{1}{i} \frac{(1-i)^N - 1}{(1-i)^N}$$

The limit of  $(P/A, i, N)$  as  $N$  approach to  $\infty$ . ( $N \rightarrow \infty$ )

$$(P/A, i, \infty) = 1/i$$

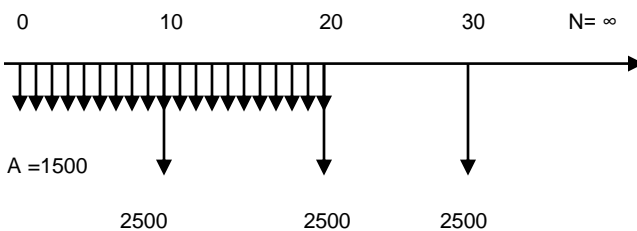
So if  $P$  represent the first cost ,we find

$$\text{Capitalized cost} = P + A(P/A, i, \infty)$$

Where,  $A$  is the uniform difference between annual receipts and disbursements. when there is no revenue , the formula become

$$\text{CAPITALIZED COST} = P + \frac{\text{DISBURSEMENT}}{i}$$

e.g Rs 5,00,000 was given to the a city for the construction and maintenance of a music hall annual maintenance for the hall is estimated Rs 15,000 / .in addition 25,000 / will be needed every 10 years for painting and major repair. How much will be left for the initial construction after funds are allocate for perpetual upkeep? Deposited fund can earn 6% annual interest and there return are not subjected to taxes .

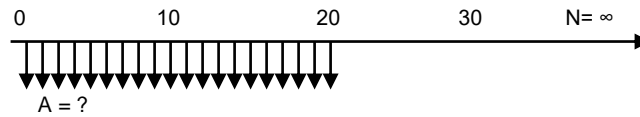


Total capitalized cost is know to be = 5,00,000 /

The equivalent annual disbursements are Rs15000 plus Rs25000 required in every 10 year

$$i = 6\%$$





$$\text{FIRST COST} = 500000.00 - \frac{15000 + 25000(A/F, 6, 10)}{0.06}$$

$$\text{FIRST COST} = 500000.00 - \frac{15000 + 25000(0.07587)}{0.06}$$

$$\begin{aligned} \text{FIRST COST} &= 500000.00 - 281613.00 \\ &= \text{RS } 218387.00 \end{aligned}$$

This means that the interest earned on the amount left after allowing Rs 2,18,387 /- for construction will cover all the anticipated up keep indefinitely provided that the interest rate remain same and also other cost will not increase over time .

### Cost reduction proposal

Sub assemblies for a model 4 scope are purchase for rs 71/ per piece and demand is 350 units and expected to continue for 3 years at the same time the model 5 scope now under development should be ready for manufacturing with equipment purchased and installed for 21000. The production cost to internally produce and installed sub assemblies should be rs 18500 for the first year and 12500 for last 2 years. The equipment will have no salvage value should the company make or buy the subassemblies.

Solution:-

$$\text{Permanent annual cost} \quad 350 \times 71 = 24850$$

$$1^{\text{st}} \text{ year Net saving} \quad 24850 - 18500 = 6350$$

$$2^{\text{nd}} \text{ and } 3^{\text{rd}} \text{ year Net saving} \quad 24850 - 12500 = 12600$$

$$\text{At } i = 10\% \quad \text{NPW} = 4652.50 > 0$$

$$\text{At } i = 15\% \quad \text{NPW} = 2333.89 > 0$$

$$\text{At } i = 20\% \quad \text{NPW} = 333.21 > 0$$

$$\text{At } i = 25\% \quad \text{NPW} = -1404.8 < 0$$

So IRR lies between 20% and 25%

$$\text{Through interpolation} \quad \text{IRR} = 20\% + (25\% - 20\%) \left[ \frac{333.21 - 0}{333.21 - 1404.8} \right]$$

$$=20\% +0.96\% = 20.96\%$$

So any proposal having MARR value below 20.96% is rejected.

**Consistency of IRR with other economic comparison method**

The acceptability of alternative courses will be identical whether they are evaluated according to their annual worth , present worth , future worth or incremental IRR

Let a function can be perform by 3 plan having following data at annual interest rate 8%

Plan	I (0)	1YR	2YR	3YR	4YR	5YR
A	0	-20000	-20000	-20000	-20000	-20000
B	-30000	-10000	-10000	-10000	-10000	-10000
C	-25000	-12000	-12000	-12000	-12000	-12000

**EAC comparison -:** EAC(plan-A)= labour expenses =20000

$$EAC(\text{plan-B})= 30000(A/P,8,5) + 15000 = 30000(0.25046)+ 10000 =17513.8$$

$$EAC(\text{plan-C})= 25000(A/P,8,5) + 12000 = 25000(0.25046)+ 12000 =18261.5 \quad \text{So, Plan-B is accepted .}$$

**PW Comparison -:** NPW (plan-A) =20000 (P/A,8,5)=20000(3.99271)= -79854.2

$$NPW (\text{plan-B}) = 30000+15000 (P/A,8\%,5)= -30000-10000(3.99271)=-69927.1$$

$$NPW (\text{plan-C}) =25000+12000 (P/A,8\%,5) = 25000+12000(3.99271)= 72912.52$$

So, plan B is preferable.

**IRR Comparison -:** here the IRR can be calculated on the basis of Incremental analysis. As the cash flow are not positive (all value are cost)

**Incremental analysis -:**

The ranking of alternatives according to their IRR values is not consistence with the PW, FW, EAW ranking.

Mutually exclusive alternatives may be analyses by incremental IRR analysis and result will be completely agree with PW,FW,EAW methods.

Incremental analysis assumed that we start with a satisfactory low investment alternatives, the analysis of higher investment based on the difference between the cash flow of the second and acceptable alternatives . these difference in cash flow in the cash flow is the incremental cash flow.

Incremental cash flow is acceptable by comparing with the MARR. if result is positive then the higher investment is the better than lower one, otherwise remove the higher investment one.

This procedure continued until all the alternatives have been evaluated.

e.g-: smallest investment is plan A, next is plan-C,

the incremental cash flow between C and A are

investment is 25000, the annual earnings from the investment are = 20000-12000 =8000

IRR<sub>(C-A)</sub> =

	0	1	2	3	4	5
C-A	-25000	8000	8000	8000	8000	8000

if  $i^* = 15\%$   $NPW(C-A) = 8000(P/A, 15, 5) - 25000 = 8000(3.35216) - 25000 = 1817.28$

if  $i^* = 20\%$   $NPW(C-A) = 8000(P/A, 20, 5) - 25000 = 8000(2.99061) - 25000 = -1075.12$

by interpolation IRR(C-A) will be 18.03%

as  $IRR(C-A) > MARR$  (18.03% > 8%) so plan C is preferable than plan A.

like that IRR (B-C) is more than MARR (8%) So, plan B is preferable than plan C.

### IRR misconceptions.

#### 1). Ranking alternatives by individual IRR values.

Ranking of alternatives on their individual IRR value can conflict with the PW method . which can be solve by incremental analysis.

#### 2). More than one possible rate of return (non-simple investment)

When the cash flow switches from +ve to \_ve more than one is called non simple investment. Here the project may have more than one roots ( $i^*$ ) where NPW will be zero. To find true IRR project balance method (PBM) is used.

#### Project balance method -:

PBM applies the IRR and ERR (MARR)to cumulative cash balance it includes interest to date.

- Determine  $i^*$ ( multiple  $i^*$  value for the cash flow) if they have. Use one value which is close to MARR for further analysis .
- Determine all  $(CB)_t$  or current balance for each period using any  $i^*$  value .this is  $CB(i^*)_t$  (t-end of the period ).
- If all  $CB(i^*)_t$  are zero or less than zero receipt in all periods t being used to pay off the project investment and so are assume to be used internally thus  $i^*$  is the true IRR value .
- If any  $CB(i^*)_t$  is positive and some are negative (it is not pure borrowing ) or IRR is still not known . the ERR is applied to positive  $CB(i^*)_t$  and IRR ( $i^*$ ) is applied to negative . now this is a mixed investment both internal and external investment.

- Apply assume IRR to negative balance and MARR or ERR or explicit rate to positive balance

If  $CB(i^*)_t$  is equal to zero. We have true IRR value which should be used for evaluation or calculate IRR.

e.g:-

0	1	2	3	4	5	6
3000	0	-10000	2000	2000	2000	2000

MARR=15%,

Arbitrary first IRR = 13%

End of period	Cash flow	Current balance $CB(IRR/MARR)_t$
0	3000	3000
1	0	$3000(1+MARR)^1 = 3000(1+0.15) = 3450$
2	-10000	$3450(1+MARR)^2 - 10000 = -6032.5$
3	2000	$-6032.5(1+IRR)^3 + 2000 = -4816.73$
4	2000	$-4816.73(1+IRR)^4 + 2000 = -3442.9$
5	2000	$-3442.9(1+IRR)^5 + 2000 = -1890.48$
6	2000	$-1890.48(1+IRR)^6 + 2000 = -136.25$

Since  $CB(IRR/MARR)_6$  is less than zero IRR is too high and need to reduced so by trial and error method true IRR is = 12.34%

If IRR is 12.8% , then  $CB(IRR/MARR)_6 = CB(12.8\%)_6 = -95.12$

If IRR is 12.3% , then  $CB(IRR/MARR)_6 = CB(12.3\%)_6 = 6.39$

If IRR is 12.34% , then  $CB(IRR/MARR)_6 = CB(12.34\%)_6 \sim 0$

True IRR is (12.34%) is less than MARR (15%) so the project is rejected.

### Historical External rate of return method (H E R R)

The occurrence of multiple  $i^*$  roots with the non simple investment return can be avoided by using the H.E.R.R method. This is based on an assumption that receipts are actually reinvested at a generally available interest rate (MARR). It is solely on the project receipts.

An unknown interest rate  $e'$  is found by equating the future worth of the receipts compounded at an explicit interest rate (i) to future worth of disbursements compounded at ( $e'$ ).

When  $i\%$  is MARR and  $e'$  exceed  $i\%$  the investment is assumed to be attractive.

e.g:-

0	1	2	3	4	5	6
3000	0	-10000	2000	2000	2000	2000

MARR=15%,

Future worth of the receipts compounded at an explicit interest rate (i) = future worth of disbursements compounded at (e')

$$\Rightarrow 3000(F/P, i\%, 6) + 2000(F/P, i\%, 4) = 10000(F/P, e'\%, 4)$$

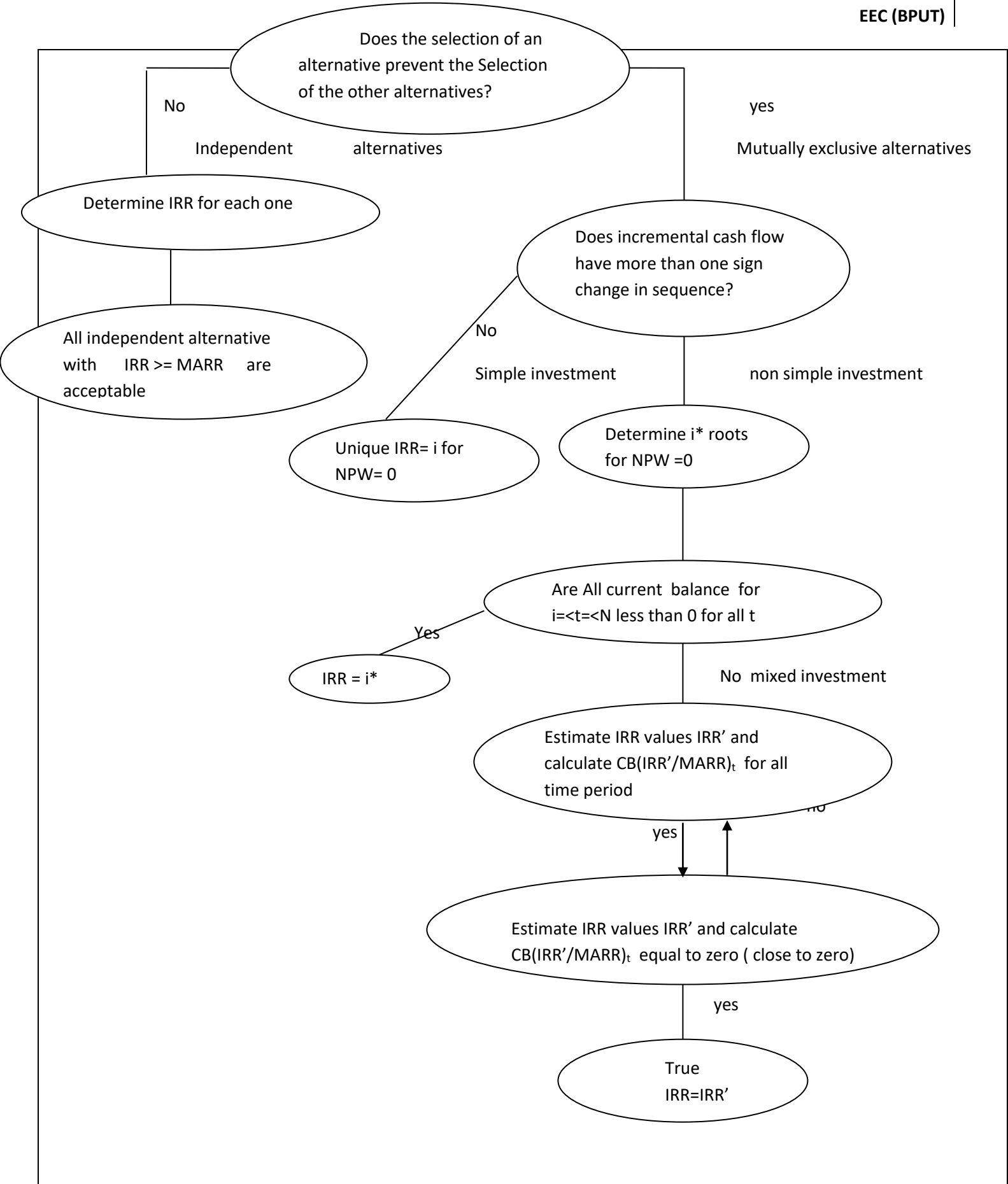
$$\Rightarrow 3000(F/P, 15\%, 6) + 2000(F/P, 15\%, 4) = 10000(F/P, e'\%, 4)$$

$$\Rightarrow (F/P, e'\%, 4) = [3000(2.31306) + 2000(4.99338)] / 10000$$

$$\Rightarrow (F/P, e'\%, 4) = 1.69259$$

By interpolation  $e' = 14\%$

since  $e'$  is less than MARR investment is not acceptable.



note all  $CB(t) \leq 0$  means that receipts are being used to pay off project investment s. MARR or other acceptable external rate of return applied to positive CBs and IRR to negative CBs .

## ANALYSIS OF PUBLIC PROJECT

Till now we have discuss about the investment in private sector the main criteria of evaluating alternatives of private sector is selecting an alternatives with maximum profit. These profit maximization criteria may not be the sole criteria in public project. Here all necessary social goods and services (social welfare) need to consider.

Public project means the project undertaken by the public authority e.g state government, central government municipalities.

The common approach to evaluate public project is Benefit / Cost analysis or cost effectiveness analysis. Basic measure for accepting project consideration is B/C ratio > one (1) or a positive difference between benefit and cost. This is B/C ratio is a standard for acceptance of a project rather ranking it.

Another representation can be B-C if Benefit and cost are in present worth Monetary term, it follows that  $PW = B - C$  will be maximize when the difference between benefit and cost is maximum. We can then rank the project according to their B-C values because B/C ratio is not an effective way for ranking.

When we talk about public project funding it is the government to set the budget and decide in which project it will invest and which transfer and regulations it will implemented. The B/C is an analytical frame work for organizing thought. Listing the pro and cons of the alternatives and determining values for all relevant factors so that the alternatives can be ranked.

### Benefit cost criteria

In comparing benefit to cost, several different perspectives are occurring. That explain why B/C analysis does not select an alternatives. Rather it provides information that can be useful in the decision making.

e.g there are 3 projects for flood control and do-nothing alternatives are mutually exclusive .

Project		Equivalent annual cost	Average annual flood damage	Annual benefit
L	No flood control	0	2,00,000	0
M	Construction of leaves	40,000	1,30,000	70,000
N	Small reservoir	1,20,000	40,000	1,60,000,
O	Large reservoir	1,60,000	10,000	1,90,000

### criteria

- Minimum investment = select "L"
- Maximum investment = select "O"

- Highest B/C ratio = select “M”
- Maximum Benefit = Select “O”
- Aspiration level = if damage due to flood by 75% select “N”
- if annual cost with in 100000 select “M”

alternatives	Annual benefit	Annual cost	B/C	B-C	Δ B	Δ C	Δ B/Δ C	Δ BΔ C
L	0	0	0	0				
M	70	40	1.75	30	70	40	1.75	30
N	160	120	1.33	40	90	80	1.125	10
O	190	160	1.19	30	30	40	0.75	-10

Maximum incremental B/C ratio chose “M”.

Largest investment that has an incremental value more than 1 choose “N”.

Only those relating to benefit cost consistently maximize the present worth.

An interpretation -:

On the basis of B-C all project are acceptable. ( more realistic interpretation is that the lower limit of accebility with respect to both total project amount and the incremental amount.)

On the basis incremental amount “0” shows negative value so “0” is rejected .

“M”and “N”are acceptable, so consideration of project includes the availability of investment fund, social features and economic objectives that affect most public interest.

$$\begin{aligned} \text{Benefit / cost comparison} &= \text{PW of benefits} / \text{PW of costs} \\ &= \text{equivalent annual benefits} / \text{equivalent annual costs} \end{aligned}$$

Or present value of net benefit (B-C) = PW of benefits - PW of costs.

alternatives	Annual benefit	Annual cost	B/C	B-C	Δ B	Δ C	Δ B/Δ C	Δ BΔ C
X1	4	2	2	2				
X2	7	4	1.75	3	3	2	1.5	1

Although X1 has higher B/C value then X2 . Incremental value B-C exceed 1 , so project X2 is preferable. Again when capital is allocated for a single project at that time X2 is accepted as X2 provide higher benefits.



e.g- 4 number of small dams made on the tributaries of a river to check floods as well as to get some other benefits. Following cost benefits /costs are given find out feasible combination of dams.

Dam site	Construction cost	Annual maintenance cost	Annual flood benefits	Annual fire benefits	Annual recreation benefits
1	12,00,000	20,000	2,00,000	20,000	30,000
1 and 2	15,00,000	35,000	1,90,000	40,000	30,000
1 , 2 and 3	27,00,000	50,000	2,80,000	60,000	60,000
1 ,2, 3 and 4	35,00,000	60,000	3,00,000	70,000	70,000

40 years of life , no salvage value 4% is deemed appropriate for the investment this rate reflect low risk involvement and is in line with historical interest rate for bond issue by the federal agency to finance public projects on the basis of B/C ratio which of four alternatives should be selected.

Soln=

B/C = Annual benefit / Annual costs

B/C = [Annual flood benefits+ Annual fire benefits+ Annual recreation benefits] / [ equivalent annual cost + Annual maintenance cost]

equivalent annual cost = initial construction cost (A/P,4%,40)

Dam site	Annual benefit	Annual costs	Increment benefit	Increment cost	Total B/C ratio
1	2,50,000	80,624			3.10
1 and 2	2,60,000	1,10,780	10,000	30,156	2.35
1 , 2 and 3	4,00,000	1,86,404	1,40,000	75,624	2.15
1 ,2, 3 and 4	4,40,000	2,36,820	40,000	50,416	1.86

For an accurate evaluation the annual benefit, equal annual costs should be applied to each separable increment of the project cost.

First site -1 compared with the no-action alternatives to yields total B/C ratio = incremental B/C ratio = 2,50,000 / 80,624 = 3.10 as B/C >1 so it is accepted.

Now check alternative -2 (site-1 and site-2) against aaalternative-1

The incremental B/C ratio = 10,000/30,156 = 0.33

B/C <1 so alternative -2 is feasible than alternative-1

Now check alternative -3 (site-1 ,2and site-3) against alternative-2

The incremental B/C ratio = annual benefit difference/annual cost difference

$$= 4,00,000 - 2,50,000 / 1,86,404 - 80,624 = 1.42$$

B/C > 1 so alternative -3 (site-1 ,2and site-3) feasible than alternative-

2.

Now check alternative -4 (site-1,2,3 and 4) against aaalternative-3

$$\text{The incremental B/C ratio} = 40,000 / 50,416 = 0.79$$

B/C < 1 so alternative -3 (site-1 ,2and site-3) feasible than alternative-4.

Without an incremental analysis the alternative -4 might have been selected as on the basis of B/C ratio as B/C > 1 or on the basis of maximum B/C ratio we choose alternative -1 which shall not be agree with PW,IRR result.

### Quantification of project cost and benefits

Cost of all resources required to achieve the objective of the project should be included in the analysis. Each alternatives should contain different type of cost and resources.(cost consideration) . a few cost consideration have particular significance to B/C analysis. All items involved in the project consider and value under a common denominator.

- **Imputed cost-(opportunity cost)** -: Imputed cost of existing assets employed on a project. When there are alternatives uses for the assets. (e.g land building used in a project can earn certain money when used in other project.)
- **Preliminary cost** -: investigation and technical services required to get a project started are a part of the project's budget.
- **Spillover cost** -: which constitute all significance adverse effects cause by the construction and operation of a project are express interm of market price.

e.g - Irrigation project could reduce quality of water downstream from area to service. The additional treatment facilities necessary to restore the quality of the water or provision for water from another sources would be cost to the irrigation project.

After enumeration of cost and benefit next step is their quantification and valuation here all the relevant items should be consider one by one valued under a common denominator (currency) use of opportunity price is recommended for the valuation of such cost.

- a) Valuation of costs and benefit not having market value.  
There are certain cost and benefits which does not have certain market values in such cases valuation has to be done by some indirect methods, like valuation of benefits from the road can be based on how and how much the individual value the saving of time due to this.
- b) In corporation of social and political judgment.  
In certain cases the valuation cannot be based upon market mechanism, rather required social and political judgment to be applied.

### Depreciation –

When ever any assets , machines or equipment is used .it loses its values and utility as the time passes .this losses cannot be prevented rather through proper maintenance one can minimise the losses. This loss is called depreciation.

As the efficiency also reduces with the time and at one time it becomes uneconomical to be used further and need to be replaced i.e the efficiency and values of an asset constantly reduces with the lapse of time during the use is called **depreciation** .

The amount of money which deducted yearly called **depreciation charge**. The amount of money is deposited in a fund is called **depreciation fund or sinking fund**.

Depreciation means a decrease in worth, most of the asset s are worth less as they age.

Depreciation is a permanent, continuing , and gradual shrinkage in book values of an fixed assets.

Depreciation can be study in 3 sense

1. Physical sense - Decline in physical ability of the equipment in the process of production.
2. Economical sense – decline in worth of an assets due to obsolence of technology , taste and preferences etc.
3. Accounting sense – It is the estimated value of fall in worth of an assets (In accounting depreciation is taken as cost of production i.e explicit cost.)The aim of accounting depreciation is to allocate the cost of assets over the service life in a systematic way.

**Causes of depreciation** –assets depreciated in values to several reason.

- **Physical depreciation-** The everyday wear and tear of operation gradually lessen the physical ability of the asset to perform the intended function.
- **Functional depreciation-**more demand may increase beyond its capacity to produce.
- **Technological depreciation-**newly developed technology may make the present technology uneconomical or obsolete since the changes in need and obsolescence cannot be accurately anticipate there direct impact is more as compare to the tax deduction. e.g-steam engine replaced by diesel engine .
- **Monetary depreciation-**A change in price level is also a cause for depreciation as decreases the value of own assets . if prices increases during the life of an asset (inflation)then comparable replacement become more expensive .this means that the capital recovered will be insufficient to provide an adequate substitute for the worn out assets and the selling price of the product does not reflect the cost of production.
- **Sudden failure-**This refers to sudden loss in the value due to technological characteristic inherent in the asset due to accident or misuse. (e.g – light bulbs burn out a result of little loss in operating efficiency.)
- **Depletion** –consumption of exhausted natural resources to produce product or services is termed as depletion.

Removal  
mineral  
the  
.this

$$\text{Depletion rate} = \frac{\text{Adjusted basis of resources}}{\text{Remaining units of resources}}$$

of oil, timber, rock or  
from a site decrease  
value of the holding  
decrease is

compensate by a proportionate reduction in the earning derived from the resources.

### Methods of computing depreciation charge –

There are several method of computing depreciation charge on an asset. These methods required input information about an asset’s basis , useful life, salvage value.

The symbols are use in the development of formulae.

**P** = purchase price or initial cost etc.    **S** = Salvage value or Future value at the end of asset life.

**N**= Useful (tax)life.    **n** = Number of years of depreciation or use from time of purchase.

**DC<sub>(n)</sub>**= Annual depreciation charges in year 'n'.

**BV<sub>(n)</sub>**=Book value shown on accounting record at the end of year "n"(adjusted basis).

$$BV_{(0)} = P$$

**C** it is the difference between the c the amount accumulated in the depreciation reserve after 1<sup>st</sup> year.

The basis for depreciation is the same as the used for figuring the gain on a sale . the original basis is usually the purchase price but this may be increased by installation charges and other onetime cost required to bring the item into use.

**Methods –**

- 1. Straight line method-** This method assume that the value of an asset depreciated at a constant rate over its life time.

The book value is the difference between the purchase price and the product of the number of years use and the annual depreciation charges are (DC).

$DC_{(n)} = \frac{P-S}{N}$	$BV_{(n)} = P - \frac{n}{N} (P-S)$
----------------------------	------------------------------------

e.g –

- 2. Declining balance method (Diminishing balance method or Reducing balance method)**

Where, 'R' may be determined by the fax payer.

If 'R' has a value greater than is the first year's depreciation charge will be greater than the Corresponding change for straightline depreciation.

When the taxpayer determines a value for 'R' the salvage value must be grater than O

This constant rate is applied to the book value [BV(n-1)] for each depreciation charge.

Since the undepreciated balance decrease each year the depreciation charge also decrease.

**Double declining balance method(DDB)**

While availing income-tax exception for the depreciation amount paid in each year,A widely version of declining method used.

Which based m the depreciation rate 'R' (which does not depend on the s/p ratio) is limited to at the most 2/n(ie under cretation circumstances a rate allowed that is twice grate as would be proper under the S.L method.This is called double declining-balance method.

It is observed from the example that Rs 544 is the book value (ie salvage value) at the end of its life According to question there is zero salvage value(assets value at the end of life). Then every possibility is there the book value exceed assests value at the end of life.If it is calculated on the basis of double-decline-balance method.

This situation always occure when s=0

Then it is usually suggested to switch to straight line depreciation.

The time to switch from DDL to SL depr<sup>n</sup> is when the straight line (S.L) charge on undepreciated portion of the asset's value exceech double decline balance (DDB)allowances.

The undepreciated portion is the difference between the assets book value in given year and It s salvage value.

e.g An assets has a first cost 7000, a 5 year useful life and has no salvage value. Determine an accelerated depreciated schedule in which BU(N)=0

Here depr<sup>n</sup> starting with DDB and switching to 'SL' after 3<sup>rd</sup> year is shown.

At the end of year2

**Type of taxes** – country impose taxes on income, property, or transactions some important taxes are

- **Property taxes** – charged by the local authority like municipality on land, building, machinery and equipments . These taxes are insignificant due to small magnitude.
- **Excise taxes-** such type of taxes are imposed on the products like Tobacco and Alcohol.
- **Income taxes** – income taxes levied on personal and corporate income at increasing at higher rate for higher income group. They are based on net income after deduction allowed for permissible expenses. It has significant influence on project acceptability.

**After tax consideration** – earlier comparison were based on before tax cash flow , when after native being compared are to satisfied a required function and are affected by identically by taxes . The before tax comparison give proper result. Public project rarely include profit but in private project consider the effect of income taxes on final result of the proposed project . Because income taxes usually represent significant cash out flow that cannot be ignore.

After tax payment occurs at the end of each period. The number of tax consideration involved are discussed below the most common are depreciation and interest deduction.

Column heading based on the tax effects are given bellow .not all the column heading shown might be required for any specific analysis.

Column heading	Column number	Arithmetic computation
Investment year	01	
Before tax operating cash flow	02	
Book value before depreciation	03	
MACRS depreciation rate	04	
Depreciation charge	05	(04) * (original basis)
Book value after depreciation	06	(03) – (05)
Cash flow for debt	07	
Cash flow for debt interest	08	
Taxable income	09	(02)-(05)-(08)
Cash flow for taxes	10	(Tax rate) *(09)
After tax cash flow	11	(02)-(07)-(10)

**After Tax comparison of proposal –**

An after tax comparison can be made by any of the comparison method i.e (P.W,F.W,A.W or IRR). Once the tax effect on the cash flows have been determined the computational procedure and interpretation of result are same .

e.g – the budget includes 45000 for purchase of new machine rate of return has been established 15% after taxes . the machine is 5-year MACRS recovery period over6 year to save rs 23000/- per year in maintenance annual operating cost being rs 7300/- . it will depreciated by MACRS method with no salvage value .T he firm has an effect composite income tax 40% . Does the proposal of buy the machine satisfy the firm’s new minimum acceptable rate of return?

