

Department of Mechanical Engineering
VII Semester
MF 441 -Process Planning and Cost Estimation
UNIT-1

1. Define Standardisation.

Standardization: primarily means setting up standards or measuring sticks by which extent, quality, quantity, value performance or service may be gauged or determined.

Definition : According to ISO (International Organization for Standardization), standardization is the process of formulating and applying rules for an orderly approach to a specific activity for the benefit and with the cooperation of all concerned and in particular for the promotion of optimum overall economy taking due accounts of functional conditions and safety requirements.

In simple terms, it is the process of defining and applying conditions required to ensure that a given range of requirements can be easily met with minimum changes in an economical and reproducible manner by the latest technique.

2. What are the aims of standardization?

1. *To achieve maximum overall economy* in terms of

- (a) Cost,
- (b) Human effort, and
- (c) Conservation of essential materials as opposed to more readily available materials.

2. *To ensure maximum convenience in use*

This objective of standardisation leads to simplification, rationalisation, interchangeability of parts and freezing of dimensions of components.

3. To adopt the best possible solutions to recurring problems.

4. To define requisite levels of quality.

5. To facilitate national and international exchange of goods and services and to develop mutual **cooperation** in the sphere of intellectual, scientific, technological and economic activity.

3. Give the classification of standardisation

1. Basic standardisation,
2. Dimensional standardisation,
3. Material standardisation,
4. Equipment standardisation,
5. Process standardisation,
6. Quantity standardisation,
7. Safety measures standardisation,
8. Personnel standardisation, and'
9. Administrative standardisation.

4. Define Basic Standardisation

It is based upon general consideration of numerical theories. It includes standardisation of various basic elements such as scales and weights, voltages, preferred numbers, preferred sizes, limits and fits, screw thread profiles, surface texture, drawing paper sizes and testing procedures.

5. Write the definition of Dimensional Standardisation.

It includes standardisation of various engineering components such as nuts, bolts, screws, gears, keys, rivets and bearings.

6. Define Material Standardisation

"The materials that are used in production are standardised in quality, size, shape and other physical aspects.

It includes standardisation of raw materials, lubricants, coolants, cotton waste, various tools, *etc.*

7. Write the definition of equipment Standardisation.

The equipments used should also be standardised. This standardization includes the specifications relating to various machines and equipments required for production, their location, layout and performance rating.

8. What do you mean by Process Standardisation?

The operation method in a factory is standardised to get the maximum benefit of ease and cheapness in production.

9. What do you mean by Quantity Standardisation?

The economical quantity (EOQ) to be produced is decided earlier and this assumes the standard for production.

10. Define Safety Measures Standardisation.

This standardisation refer to rules and regulations formed to assure the safety of men and machines in a factory.

11. Write Personnel and Administrative Standardisation.

This standardisation refers to workers' selection, training and aptitude, their wage rates and operating times.

This standardisation refers to office methods and procedures to assure a most efficient working.

12. What are the benefits of standardization?

1. Reduction of material waste and obsolescence.
2. Reduced manufacturing cost per unit and hence the reduced price.
3. Uniform quality of the product.
4. Reduced maintenance, servicing and replacement of equipment and parts.
5. Reduced work-in-process and finished products, inventories,
6. Reduced book-keeping and other documentation work.
7. Increased customer confidence to buy products.
8. Better and quicker product deliveries.

14. Define simplification.

Simplification is the process of reducing the variety of products manufactured *i.e.*, variety reduction.

Simplification of product refers to the elimination of excessive and undesirable or 'marginal lines' of product to eliminate waste and to achieve economy.

Simplification is concerned with the reduction of product range, assemblies, parts, materials and design.

Simplification is also termed as Product line contraction.

Simplification makes a product or assembly, simpler and less complex.

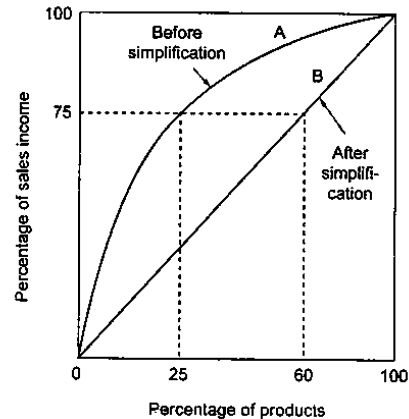
Simplification enables the production department to improve planning, achieve higher rates of production and machine utilisation, and simplify control procedures.

15. What are the considerations in simplifying products?

Before simplifying any product, one should ask himself the following questions :

- (i) Whether simplification can be achieved effectively for the nature of the given product ?
- (ii) How the simplification will affect customer demand and volume of sale ?
- (iii) Does market competition permit simplification or it encourages product diversification ?

16. What is the effect of simplification?



Effect of simplification on Pareto diagram

The figure shows the pareto diagram drawn between the accumulated sales income and the number of products offered for sale.

In this figure curve A reveals that 25% of the products brought in 75% of the income. This is referred as "25% to 75%" relationship. This 25% to 75% model is undesirable and it leads to unnecessary drain of the firms efforts. A more desirable situation is when responsibility for income is more evenly distributed between products, as the curve B (flat curve) in Figure. It is understood that curve B is achieved through variety reduction i.e., simplification.

17. What are the benefits of simplification?

- (i) It reduces manufacturing operations and risk of obsolescence.
- (ii) It makes possible the effective utilisation of special purpose and automatic machines.
- (iii) It simplifies production planning and supervision.
- (iv) It leads to lower manufacturing costs and higher sales.
- (v) It provides quick delivery and better after-sales service.
- (vi) It reduces inventory and hence better inventory control.
- (vii) It improves product quality.

18. Define product design & selection.

Product design is a critical function in the production system. The commercial success and societal value of a product is mainly determined by the quality of that product design. It is proven that a very significant portion of the cost of the product is determined by its design. If the product design is poor, no matter how well it is manufactured, the product will not contribute to the wealth and well being of the firm that produced it. How manufactured products are designed and how the process to produce them is selected are the focuses of this section.

19. Define product design.

Product design deals with conversion of ideas into reality and, as in other forms of human activity, aims at fulfilling human needs.

20. What designing includes in product design?

- (i) Specifications
- (ii) Experimental and development work for the production of desired product ;
- (iii) Calculation of all estimates; and
- (iv) Issuing necessary instructions to the production department for production.

21. What are the characteristics of a good product design?

(i) *Repairability*: The design of the product should be such that it is easily repairable whenever necessary.

(ii) *Modular design* : The product should be composed of detachable components or sub assemblies so that whenever any part of component fails that part can be replaced by a new one.

(iii) *Redesigning (ie., upgrading) capability* : The product should be possible for customers, who purchased the base' model, to subsequently buy additional options to upgrade the product.

(iv) *Miniaturisation* : The product should be smaller and lighter in weight

(v) *Drawing and specifications*: The drawings of the design should be explicit in exact size and shape of the product, its parts and sub components. The specifications of each part, operation and process involved should be clear and detailed.

(vi) *Reliability* : The designed product should have required d of reliability.

(vii) *Maintainability* : *Product* design should be such that it is easy to achieve accessibility for servicing.

(viii) *Functionality* : The product should function correctly.

(ix) *Warranties* : The product should be given warranty for a specific period.

22. What are factors influencing the Marketing Aspects in product analysis?

After the product selection, it is important to know the marketability of the product.

All further steps are dependent upon the demand for the proposed product and customer acceptability to the product.

It is easy to estimate the demand for the existing product. But if the product is entirely new, then a detailed market survey should be carried out to estimate the demand for the product.

Thus, marketing aspects which analyses the factors that influence the demand for the product is an important step in product analysis.

23. What are factors influencing the Functional Aspects in product analysis?

The functional analysis helps in analysing the importance and worth of each function to be built into the product. Some of the functional aspects are :

- (a) What are the functions the product is expected to perform ?
- (b) Whether we should go for a single function or multiple functions ?
- (c) Cost considerations for multiple functions.

For example, a kitchen mixer allows for a large number of attachments to be added for a variety of duties.

24. What are factors influencing the Operational Aspects in product analysis?

After determining the functional aspect, the operational aspect has to be considered.

The product should be easy to handle and operate at the customers end.

The product is used at different operational conditions and the customers vary with respect to skill and knowledge. Therefore these operational aspects should be considered while designing the product.

25. What are factors influencing the Aesthetic Aspects in product analysis?

Aesthetic aspect refers to the style or external look of the product. It is concerned with moulding the final shape around the basic skeleton.

Aesthetic aspects attract customers and create the first impression about the product.

The designer can improve the aesthetic value of a product by using special materials, changing different colours, textures, lines, packaging methods.

26. What are factors consider for Economic analysis? Economic Analysis

Economic analysis is concerned with the answers to the following questions

1. How much investment is needed to manufacture the new product ?
2. Who are the estimated production cost per piece ?
3. What is the expected volume of sales ?
4. What will be the expected profit margin ?

Techniques like breakeven analysis, cost volume profit analysis are used to do these economic analysis.

27. Write the approaches to process planning.

The two general-approaches to, process planning are

- I. Manual process planning, and
2. Computer Aided Process Planning (CAPP).

- (i) Retrieval CAPP system, and
- (ii) Generative CAPP system.

28. Define manual process planning.

In traditional process planning systems the process plan is prepared manually. The task involves examining and interpreting engineering drawings, making decisions on machining processes selection, equipment selection, operations sequence, and shop practices. Therefore, the manual process plan is very much dependent on the skill, judgement and experience of the~process planner. That's why, if different planners were asked to develop a process plan for the same part, they would probably come up with different plans.

29. Write Advantages and Disadvantages of Manual Process Planning.

Advantages

Manual process planning is very much suitable for small scale companies with few process plans to generate.

This method is highly flexible.

This requires low investment, costs.

Disadvantages

Manual process planning is a very complex and time consuming job requiring a large amount of data.

This method requires the skilled process planner.

More possibilities for human error

It increases paper work

30. Define CAPP

In order to overcome the drawbacks of manual process planning,

The Computer Aided Process Planning (CAPP) is used. With the use of computers in the process Planning

One can reduce the routine clerical work of manufacturing engineers, Also it provides the opportunity to generate rational consistent and optimal plants. In addition CAPP provides interface between CAD and CAM.

31. What are the approaches of CAPP?

The two basic approaches or types of CAPP system are :

1. Retrieval (or variant) CAPP system,, and
2. Generative CAPP system.

32. Define retrieval (or variant) CAPP system.

1. A retrieval CAPP system, also called a variant CAPP system, has been widely used in machining applications.

1. The basic idea behind the retrieval CAPP is that similar parts will have similar process plans.
2. In this system, a process plan for a new part is created by recalling, identifying and retrieving an existing plan for a similar part and making the necessary modifications for the new part.

33. Drawbacks of Retrieval CAPP System

The components to be planned are limited to similar components previously planned.

Experienced process planners are still required to modify the standard plan for the specific component.

The retrieval CAPP system has the capacity to alter an existing process plan. That's why it is also known as **variant CAPP** system

The commercially available retrieval CAPP systems are MultiCapp and MIPLAN.

34. Define generative CAPP systems.

In the generative approach, the computer is used to synthesize or generate each individual process plan automatically and without reference to any prior plan.

A generative CAPP system generates the process plan based on decision logics and precoded algorithms. The computer stores the rules of manufacturing and the equipment capabilities (not any group of process plans).

When using a system, a specific process plan for a specific part can be generated without any involvement of a process planner.

The human role in running the system includes:

- (i) inputting the GT code of given part design. and
- (ii) monitoring the function.

35. What are the Components of a Generative CAPP System

The various components of a generative system are :

1. A part description, which identifies a series of component characteristics, including geometric features, dimensions, tolerances and surface condition.
2. A subsystem to define the machining parameters, for example using look-up tables and analytical results for cutting parameters.
3. A subsystem to select and sequence individual operations decision logic is used to associate appropriate operations with features of a component, and heuristics and algorithms are used calculate operation steps, times and sequences.
3. A database of available machines and tooling.
4. A report generator which prepares the process plan report.

36. Advantages of Generative CAPP.

Generative CAPP has the following advantages

1. It can generate, consistent process plans rapidly.
2. New components can be planned as easily as existing components.
3. It has potential for integrating with an automated manufacturing facility to provide detailed control information.

37. What are the factors should be considered for process and equipment selection?

While selecting a process or equipment, the following factors considered -

1. *Economic-consideradons*: Cost analysis should be made with respect to the initial cost, maintenance and running cost. An alternative which results in lower total cost should be selected
2. Production rate and unit cost of production.
3. Quality and reliability aspects.
4. Lower process rejection.
5. Minimum set-up time.
6. Longer productive life of machines or equipment.
7. Functional versatility *ie.*, ability to perform. more than one function.

38. Define process analysis

1. *Process analysis*, also known as *method study*, enables th ti industrial engineer to subject each operation to systematic analysis.
2. It analyses each step of the manufacturing process and aims at improving the industrial operations.
3. Process analysis helps in finding better methods of doing a job and this is achieved by eliminating unproductive and unnecessary elements of the process.
4. The process is analysed with the help of process charts and flow diagrams.

UNIT-II

39. What are the objectives of process analysis?

The main objectives of process analysis are

1. To improve work methods and procedures.
2. To determine the best sequence of doing work.
3. To eliminate the waste and unproductive operations.
4. To improve plant utilisation and material utilisation.
5. To improve the working conditions and hence to improve labour efficiency.
6. To eliminate unnecessary fatigue and thereby effect economy in human effort.

40. What are the steps involved in process analysis?

Steps involved in carrying out a complete a process analysis *i.e., method study* are as follows

1. Selection : Select the process or job to be studied keeping in technical and economical factors.
2. **Recording** : Record all facts regarding present and proposed to work methods using appropriate recording techniques. The recording can be done with the help of process charts and diagrams.
3. Examining: Analyse or examine the recorded facts carefully and critically to see whether some elements can be eliminated combined or simplified. This step will expose defects in the existing methods. The purpose place and sequence of every operation should examine.
4. **Developing new method**: Develop the new and improved method. Development involves the analysis of the three phases of evaluation investigation and selection.
5. **Defining the new method**: Define the new method and its requirements
6. **Installing the new method**: Install the new method with the cooperation of supervisor and operator. Installation refers to the implimentation of the proposed method. It is composed of two phases recommendation implementation.
7. **Maintaining the new method**: Maintain the new method as the standard practice and verify with the help of proper control procedures that it is achieving the desired results.

41. Write the various charts and diagrams used for process analysis.

Chart / Diagram	Application
1 Operation process chart . (Outline process chart)	Gives bird's-eye view of process and records principal operations and inspecting.
2 Flow process chart . (a) Man type (b) Material type (c) Equipment type	Sequence of activities performed by worker. Sequence of activities performed on materials. Sequence of activities performed by equipment.
3 Multiple activity chart .	Charts activities of men and / or machines on a common time scale.
4 Two handed process chart .	Activities performed by * worker's two hands.
5 Travel chart .	Movement of materials and or men between departments.
6 Flow and string diagrams .	Path of movement of men and materials.

42. Define Break-Even Analysis

Break-even analysis, also known as **cost-volume-profit** analysis, is the study of inter-relationships among a firm's sales, costs and operating profit at various levels of output. It reveals the effect of fixed costs, variable costs, prices, sales, etc., on the profitability of a firm. It is a simple method of presenting to management the effect of changes in volume on profit. It is concerned with finding the point at which revenues and costs are exactly equal. This point is known as *break-even Point*

43. What are the Aims of break-even analysis?

The important aims and objects of break-even analysis are :-

1. To help in deciding profitable level of output, below which losses will occur.
2. To compute costs and revenues for all possible volumes of output to fix budgeted sales.
3. To take decision regarding make or buy.
4. To decide the product mix and promotion mix.
5. To take plant expansion decisions.
6. To take equipment replacement decisions.
7. To indicate margin of safety.
8. To fix the price of an article to give the desired profit.
9. To compare a number of business enterprises.
10. To compare a number of facility locations.

44. What are the assumptions in break-even analysis?

The break-even analysis is based on the following assumptions :

1. Selling prices will remain constant at all sales levels (i.e., quantity discounts are not available).
2. There is linear relationship between sales volume and costs.
3. It assumes that costs are classified into fixed and variable costs, ignoring semi-variable costs.
4. It considers that production is equal to/ the sales (i.e., there is no inventory).
5. No other factors will influence the cost, except the quantity.

45. What you mean by break-even point?

1. The ***break-even point*** may be defined as the level of sales at which total revenues and total costs are equal. It is a point at which the, profit is zero.
2. It is also known as "no-profit ***no-loss point***".
3. If a firm produces and sells above the break-even point, it makes profit. In case it produces and sells less than the breakeven point, the firm would suffer losses.
4. Management can change the break-even point by changing fixed cost, variable-cost and selling price.

46. What are the method of determination of break even point?

- (i) The algebraic method, and (ii) The graphical method.

47. Define algebraic method.

Break Even point in terms of Physical Units: Let FC = Fixed cost, VC = Variable cost per unit, VC = Total variable cost, TC = Total costs, TR = Total revenue *i.e.*, total income, Q = Sales volume *Le.*, quantity sold, and SP = Selling price per unit that,

We know that

Total costs = Fixed cost + Variable cost

$$TC = FC + (VC \times Q)$$

We also know that

Total revenue = Selling price / unit x Quantity sold

$$TR = SP \times Q$$

At Break Even Point (BEP),

Total costs = Total revenue

$$TC = TR$$

$$FC + (VC \times Q) = SP \times Q$$

$$Q_{BEP} = FC / (SP - VC)$$

Fixed costs

Break Even quantity = (Selling price / unit) - (Variable cost / unit)

48. What do you mean by *Break-even point in terms of Sales Value*?

This method is suitable for a multi-product firm.

$$\text{Break-even sales (BEP in rupees)} = \frac{\text{Fixed costs}}{1 - \frac{\text{Variable cost/Unit}}{\text{Selling price / unit}}}$$

49. Define contribution

The difference between selling price and variable cost per unit is known as **contribution or contribution margin**.

Contribution = Selling price - Variable cost

$$C = SP - V_c$$

Contribution is a companion measure of value that tells how much of the revenue from the sale of one unit of a product will

contribute to cover fixed costs with the remainder going to profit,

Contribution margin divided by selling price is known as **contribution ratio**.

$$\text{Contribution ratio} = \frac{\text{Contribution}}{\text{Selling price}}$$

_Selling price

50. Define P/V Ratio (i.e., Profit - Volume Ratio)

$$\text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}}$$

51. What do you mean by margin of safety?

Margin of safety is the difference between the existing level of output and the level of output at BEP.

$$\text{Margin of safety (in \%)} = \frac{\text{Sales} - \text{Sales at BEP}}{\text{Sales}} \times 100$$

Greater value of margin of safety means higher profits to the firm.

If the safety margin is low, then the firm runs the risk of incurring losses.

52. What are the limitations of break-even analysis?

- (i) Break-even analysis is a static picture as it assumes constant relationship of output to costs and revenue.
- (ii) Practically, the selling price and variable cost per unit are not constant. So the break-even analysis cannot be more realistic.
- (iii) Break-even analysis is based on accounting data which may suffer from several limitations like neglect of imputed costs, arbitrary depreciation estimates, inappropriate allocation of overheads, etc.
- (iv) The break-even chart is a tool for short run analysis. It cannot be used for long-range analysis.

UNIT-III

1. What are factors for calculating the probable cost of the product?

- (i) Design time,
- (ii) Amount and. cost of materials required,
- (iii) Production time required,
- (iv) Labour charges,
- (v) Cost of machinery, overheads and other expenses,
- (vi) Use of previous estimates of similar parts,
- (vii) Effect of volume of production on costing rates,
- (viii) Effect of changes in facilities on costing rates, and
- (ix) Probable future changes in unit prices for materials, labour and expenses when the proposed product is manufactured at a future date.

2. Write the . importance of cost estimating?

Cost estimating is very important for all organisations, before starting actual production or filling up the tenders. Because only accurate estimating, can enable the factory - owner to make vital decisions such as manufacturing sel ling policies. Both, over estimating and under-estimating are dangerou's f6r a 'concern.

If a job is over-estimated, *i.e* the estimated cost is much more than the actual cost of the product, then the firm will not be able to compete with its competitors who estimated the price correctly and loses the order to its competitors. On the contrary, -if the job is underestimated, *i-e.*, the estimated cost is below the actual, cost; of product, then the firm will. face, huge fin~tncial loss which may cause utter failure or closure 'of the firm. Therefore a realistic and accurate estimating should be done. Hence the staft preparing estimates be highly qualified and experienced.

3. Write the aims of cost estimation?

To establish the selling price of a product for a quotation or contract, so as to ensure reasonable profit to the company.

To ascertain whether the proposed product can be manufactured profitably,

To take make or buy decisions, *i.e.*, to determine whether the part or assembly can be manufactured economically, in the plant itself or to be purchased from outside.

To determine the most economical process, tooling or material to manufacture the product.

To establish the standard of performance that may be used to control costs.

To prepare production budget.

To evaluate alternate designs of product.

To initiate means of cost reduction in existing production facilities by using new materials, new methods of tooling and processing.

4. What are the functions of cost estimation?

Cost estimates are required to submit accurate tenders for getting the contracts.

Cost estimates are required for the manufacturer to choose from various methods of production the one which is likely to be most economical.

Cost estimates are required for fixing the selling price of a product.

Cost estimate gives detailed information of all the operations and their costs, thus setting a standard to be achieved in actual practice.

Cost estimate enables the management to plan for procurement of raw materials, tools, etc., and to arrange the necessary capital, as it gives detailed requirement.

5. Give the types of estimates?

The four groups of estimates generally used in a manufacturing enterprise are :

1. Estimates for fixing the selling price of the product.
2. Estimates to help the contractors to submit accurate tenders for entering into new contract.
3. Estimates for setting various standards for the purpose of comparison.
4. Estimates to forecast the progress of production and cost of the order to keep control of any variation of the material costs.

6. Write the importance of realistic estimates?

Three possible estimating are (i) Over estimation, (ii) Under-estimation, and (iii) Realistic estimation.

Both the over-estimation and underestimation are dangerous because both will ultimately lead the enterprise to failure. In over estimating, the firm will not be able to compete with its competitors who estimated the price correctly and loses the order to its competitors. In case of under estimating, the firm will face huge financial loss which may utter failure or closure of firm. Therefore a realistic estimation is the need of the hour for any concern.

7. What are the components of a job estimate ?

Before doing the cost estimation of a product, one should know the constituents of estimation. The total estimated cost of a product of the following cost components. Design

cost,

R & D cost,

Labour cost,

Drafting cost,

Materials cost,

Inspection cost,

Cost Of tools,

jigs and fixtures, and

Overhead cost.

8. Define Design Cost?

'The cost of design of a. product is estimated by ascertaining the expected time for the design of that product..

Estimated design cost = Estimated design time x Salary of designer per unit time.

The design time can be estimated on the basis of similar products already designed in the past or on the basis of good judgement of designer.

If the design of the product is done by some outside agency, the total amount paid to outside agency gives the cost of design.

9. Define Drafting Cost

After the completion of the design, the drawing have to be prepared by draftsman.

Drafting cost = Estimated time by draftman in preparing drawings x Salary of the draftsman per unit time

10. Define Cost of Research and Development Work

Considerable time and money has to be spent on research and development work. The research may be theoretical, experimental or developmental research. The estimated time and the costs to be incurred on it are decided by judgement or past experience.

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11 . Define cost and Maintenance Charges of Tools, Jigs and Fixtures.

Estimated cost of a product includes the estimated cost and maintenance charges for the tools, jigs, fixtures and dies required in the production.

Cost of tools' jigs' fixtures, etc., are estimated considering their present prices, market trend and the number of times a particular tool can be used during its life-time.

Tool cost per unit produced = Estimated cost/no. of job

12. Define over head cost

'overhead expenses are those whICHeannot be charged directly to a particular product manufactured.

All expenses other than the direct material cost, direct labour

cost, and direct expenses are known, as overhead costs or indirect expenses. Administrative expenses, selling and distribution expenses are added to the overhead costs.

The overhead costs may be estimated by referring to the records of overhead costs in similar parts produced in past.

13. Define Costing

' *Costing is the determination of an actual cost of a component after adding different expenses incurred in various departments.*

' Costing or cost accounting may be defined as a systematic procedure for recording accurately every item, of expenditure incurred on the manufacture of a product by different sections of any manufacturing concern.

14. What are aims of costing?

The main aims of costing are

1 *Cost determination:* To determine the actual cost of each mponent and cost of the final product.

2 *For fixing selling price:* To provide information to ascertain e selling price of the product.

3. *Cost control -* To analyse the expenses incurred in production, that control can be kept over them.

4. *Comparison with estimate* : To compare the actual cost with the estimated cost to know whether the estimate had been realistic or not.

5. *Make or buy decisions* : To decide which of the components to be manufactured and which parts to be purchased from outside.

6. *Wastage reduction* : To help in detecting the undesirable wastages and expenses, so that corrective measures can be taken.

7. *To suggest changes in design* : To suggest changes in design, if the cost of production is higher as compared to the competing product.

8. *Profit and loss* : To locate the reasons for the increase or decrease in profits or loss of a company.

9. *Fixing the discount*: To help in determining the discount on catalogue or market price of the product.

10. *Pricing policy*: To help in formulating the policies for changing or prices of the product.

11. *Budget preparation* : To help the enterprise to prepare its budget.

12. *For preparing quotations / tenders* : To facilitate preparation of estimate for submitting in quotations or tenders.

13. *Output targets*: To help in regulating, from time to time, the production of a job so that the enterprise can earn more profits.

14. *Legal provisions*: To meet certain legal and government regulations, cost data is necessary.

15. *Purchasing new machines / plants*.- To provide information for economic consideration for purchasing new machines, plants, etc.

15. What are the importance of costing?

Costing is necessary because it provides information for :

- (i) Determining, classifying and analysing the cost and incurring to a business firm.
- (ii) Determining the prices to be quoted to customers.
- (iii) Forming basis for managerial decisions that have to do with,
 - (a) Make or buy decisions,
 - (b) To introduce a new product or to drop an existing one, and
 - (c) To expand or contract the existing one. Cost control through accumulation and utilisation of cost data.
- (iv) Establishing standards for measuring efficiency.

16. Difference between estimating and costing

Particular	Estimating	Costing
Nature of cost	It gives the probable cost of the product before the start of its manufacture.	It gives the actual cost of the product after adding different expenses incurred in v . arious departments.
Quality of personnel required	Estimation requires a highly technical knowledge hence an estimator is basically an engineer.	Costing requires the knowledge of accounts and therefore costing is done by accountants.
Duration of process	Estimating is carried out before the actual production of a product.	Costing usually starts with the is\$ue of order for production of a product and ends after the product is dispatched on sale.
Main objectives	(i) To establish the selling price of a product for a quotation or contract. (ii) To take make or buy decisions of parts. (iii) To ascertain whether the proposed product can be manufactured and marketed profitably.	(i) To determine the actual cost of the final product. (ii) To form a basis for fixing the selling price., (iii) To check the accuracy of estimates. (iv) To help in detecting the undesirable wastages and expenses.
Organising department	Estimating work is done under the planning department.	Costing work is done under the accounting department.

17. Write the common methods of costing.

1. Job costing or order costing,
2. Batch costing,
3. Process costing,
4. Departmental costing,
5. Operating cost method,
6. Unit cost method, and
7. Multiple cost method.

18. Define Job Costing or Order Costing

This method is concerned with finding the cost of each individual job or contract. In this method, the total cost for each order is obtained from the daily cost sheet. This method is adopted in job order industries such as ship building, machine manufacturing, fabrication, building contracts, etc.

19. Define Batch Costing

Batch costing is a form of job costing. In this method, instead of costing each batch of components separately, each batch of components is taken together and treated as a job.

20. What you mean by Process Costing?

1. This method is employed' when a standard product is made which involves a number of distinct processes performed in a definite sequence.
2. This method is adopted in industries such as oil refining, chemical, paper making, paint, cement manufacturing and other similar industries.
3. This method indicates the cost of a product at different stages as it passes through various operations or processes. or departments.

For example,, in the manufacture of cement, the operations of mixing, grinding the raw material, burning, cooling and grinding the clinker are readily separable and cost of each of these stages can be accurately calculated.

21. Define Departmental Costing

1. This method is adopted in determining the cost of the output of each department separately for the manufacture of the standardised products.
2. This method is applied in industries like steel industry, automobile industry, *etc.*, where each department is producing independently one or more components.

3. In this method, the actual expenditures of each department on various components is entered on a separate cost sheet and the costing for each department is separately undertaken.

22. Define Operating Cost Method

This method is used in firms providing utility services.

Example : In transport services, water works, electricity boards, railways, etc., cost is determined on the basis of operating expenses. That is, charges are made as passenger per km per m³ volume, per kilowatt-hour, tonne, *etc.*

23. Define Unit Cost Method

This method is adopted by the firms, which supply a uniform product rather than a variety of products such as mines, quarries, *etc.*

24 . Define Multiple Cost Method

This method is used in firms which manufacture variety of standardised products, having no relation to one another in cost, quality and the type of process, *etc.*

25. What you mean by materials cost?

It is the cost of materials required for the manufacturing of the product. It consists of

- (a) Direct material cost
- (b) Indirect materials cost.

Direct Materials Cost

It is the cost of direct materials required for the manufacturing of the product.

Indirect Material Cost

It is the cost of material which are essentially needed in various shops for helping the direct materials to be converted into finished product.

26. What is meant by direct material ?

Direct material is one which becomes a part of the product. It is the material which is consumed in the manufacturing of product. It can be measured and charged directly to the cost of the product.

Direct materials are also known as 'Productive materials'. 'Process materials'. 'Store materials'. 'Constructional materials'. and 'Prime cost materials',

Examples of direct materials are : Mild steel bar used to manufacture spindles, C 1. used to manufacture pulleys, wood used for making a table, plastics used to make buckets, *etc.*

27. What is mean by Indirect Materials?

Indirect material is the one which cannot be traced as a part of the product. It is the material required for maintaining and operating the plant and equipment but cannot be a part of the product.

Examples of indirect materials are: Grease, lubricating oil used to lubricate the equipments, coolants used to cool the job and the tool, cotton waste, kerosene, *etc.*

28. How to determine of materials cost?

1. Study the given drawing carefully. Then breakup the product into simple geometrical shapes such as cubes, prisms, cylinders, etc., so that their volume can be easily calculated.
2. Calculate the volume of each part by applying the formulae of mensuration.
3. Add volumes of all the parts to get the total volume of the Product.
4. Calculate the weight of material by multiplying the volume, by its density.
 5. Finally, calculate the material cost by multiplying the cost per unit weight to the weight of the material

29. Define Direct Labour Cost

Direct Labour Cost

It is the wages paid to the direct labour.

Direct labour are the workers who actually work or process different materials either manually or with the help of machines.

Direct labour cost can be charged directly to, the job under preparation.

Direct labour is also called as '*Productive labour*', '*Operating labour*'. and '*Process labour*'.

Examples of *direct labour* are : *Workers* or operators working on various machines in different shops like machine shop, welding shop, foundry shop, carpentry shop, sheet metal shop, *etc.*

30. Define Indirect Labour Cost

It is the wages paid to the indirect labour.

Indirect labour are the non productive staff who helps the productive labour in performing their duties.

Indirect labour cost cannot be charged directly to a particular job, but are charged on the number of products produced in the plant during a particular period.

Examples of *indirect labour* are : *Supervisors*, inspectors, foreman, store keepers, time keepers, watchmen, gangmen, drivers, *etc.*

31. How to determined of direct labour cost?

Since the labour cost contributes a significant amount of total cost of product therefore the effective and efficient determination of labour cost is essential.

In order to calculate the labour cost, an estimator must have the knowledge of

- i) all the operations involved,
- ii) the tools, and
- iii) the machines used for production.

32. What are the factors considered for calculating the time required for a particular job?

- (i) Set up time,
- (ii) Operation time,
 - (a) Handling time, and (b) Machining time.
- (iii) Tear down time,
- (iv) Miscellaneous allowances,
 - (a) Personal allowances, (b) Contingency allowances (c) Fatigue allowances,
 - (d) Process allowances, (e) Interference allowances, and. (f) Special allowances.

33. Define Tear Down Time

It is the time taken to remove job, tools, and other auxiliary equipment from the machine after the last element of operation has been completed.

34. Write the definition of Miscellaneous Allowances

Allowance is the additional time allowed to perform the Work over and above the basic time.

To obtain the standard time a proper allowances must be added depending upon the working conditions.

$$\text{Standard time} = \text{Basic time} + \text{Allowances}$$

35. Define Personal Allowances

They are provided to the worker to fulfill his / her personal needs such as washing hands, going to the lavatory, getting water, tea, coffee, etc.

They are usually taken as 5% for male and 7% for female worker of the total working time.

36. Define Fatigue Allowances

They are intended to provide a workman an opportunity to recover from physiological and psychological effects of fatigue caused by carrying out a specified task under specified conditions.

Fatigue may be due to excessive work, repeated work, poor lighting, poor ventilation, machine noises, visual and mental strain, etc.

Generally 5% of the total time is considered as fatigue allowance.

37. Define Contingency Allowances

These allowances are provided for small unavoidable delays as well as for occasional and minor extra work.

Some of these occurrences are : Tool breakage, tool sharpening, tool replacing, filling coolant reservoirs, consulting with foreman, daily oiling and cleaning, power failures of small duration, etc.

They are usually less than 5% of the total time.

38. Define Process Allowances

These are allowances provided to compensate for enforced idleness during a process.

They include loss of time due to no work, power failure, faulty material, and faulty tools or equipments.

39. Define Interference Allowances

This allowance is provided when two or more work elements occur simultaneously.

For example, when one worker is attending more than one machine, then interference idle time on one machine will result.

40. Define Special Allowances

These allowances are provided for activities which are not normally a part of the operation cycle, but they are essential for satisfactory performance of the work. These include the following:

1. Start up allowance,
2. A shut down allowance,
3. A cleaning allowance,
4. Tool allowance (for adjustment and maintenance of tools), and
5. Change over allowance.

41. Define Direct Expenses

Direct expenses are those which can be charged directly to a particular job and are done for that specific job only. Direct expenses are also known as '*chargeable expenses*'.

Examples of direct expenses are

Cost of preparing designs, drawings for the manufacture of a particular product.

Cost of experimental work done specifically for a *particular* product.

Cost of procuring or manufacturing special types of jigs and fixtures for the manufacture of a particular product.

Cost of hiring special types of patterns, moulding flasks, dies, *etc.*

Cost of consultancy charges for design and manufacture of a specific product.

42. Define Indirect Expenses (Overhead Expenses)

Indirect expenses are those which cannot be charged directly to a particular product manufactured.

All expenses other than the direct material cost direct labour cost and direct expenses are indirect expenses. ' Indirect expenses are also known as '*Overhead charges*' '*On cost* and '*Burden*'.

43. What are the analysis used for overhead expenses?

- (a) Factory expenses,
- (b) Administrative expenses,
- (c) Selling expenses, and
- (d) Distribution expenses.

44. Define Factory Expenses

It includes all indirect expenses which are incurred in connection with manufacture of the products, right from the receipt of the work order till it is completed and ready for despatch.

Factory expenses are also known as '*Factory on-cost*, '*WorksOn-cosj*, '*Factory overhead*', '*Works overhead*' '*Production overhead*' etc.

45. Define Administrative Expenses

It includes the expenses which are incurred for general administration and management for efficient and proper functioning of the enterprise.

Administrative expenses are also known as '*Office expenses*', and '*Establishment on-cost* ~

46. Define Selling Expenses .

These are the expenses which are incurred for creating and enhancing the demand for the products.,

It includes the expenditures spent towards securing orders, creating and retaining markets for the products manufactured.

Exanples of selling expenses are:

- (i) Expenses incurred on salaries of sales manager, clerks and attendants in the sales department.
- (ii) Salaries, commissions and travelling expenses of sales . representatives or agents.
- (iii) Cost of advertisement and publicity.

47. What you mean by distribution Expenses?

These are the expenses which are spent for the distribution of the product. ,

It includes the expenditure made on holding finished stock, packing cost and dispatching them to the customer.

Examples of distribution expenses are:

- (i) Expenses incurred on packing and forwarding.
- (ii) Salaries of workers employed for packing the products.
- (iii) Salaries of stores officer, store keeper and their assistants, *etc.*
- (iv) Expenses incurred on loading and unloading, freight, welfare and transportation.

48. What are the components of cost?

- 1. Prime cost,
- 2. Factory or works cost,
- 3. Manufacturing or production cost,
- 4. Total or ultimate cost, and .
- 5. Selling price.

49. Define Prime Cost

Prime cost is also called as '*Direct cost*'. It consists of direct material cost, direct labour cost and direct expenses.

50. Define Factory or Works Cost

It consists of prime cost and factory expenses.

Factory cost = Prime cost + Factory expenses

51. Define Production or Manufacturing or Office Cost

It is the cost of manufacturing a product. It includes the cost of each item incurred in manufacturing the finished product, right from purchasing the raw material to the point when the finished product is ready for sale.

It consists of factory cost and administrative expenses.

Manufacturing cost = Factory cost + Administrative expenses

52. What you mean by Depreciation?

It is the method of spreading the cost of fixed asset over the life or expected years of use. Depreciation is the process of an acquisition cost of the asset less salvage value if any in a systematic and rational manner over the estimated life of the asset.

53. What are the causes of depreciation?

Depreciation due to physical conditions

- 1. Wear and tear

2. Physical decay
3. Accident
4. Poor maintenance and neglect

Depreciation due to functional conditions

1. Inadequacy
2. Obsolescence

54. What you mean by Depreciation due to Wear and . Tear?

We know that when a machine is subjected to regular use, wear and tear, of certain components takes place due to the presence of friction between sliding and / or rotating parts. The friction cannot be eliminated totally even if we take sufficient precautions such as proper lubricating and cooling.

This reduction in the efficiency and value of the plant because of wear and tear is known as *depreciation due to wear and tear*.

55. Define Depreciation due' to Physical Decay

There are certain. items or equipments of a factory which do not have motion but get decay because of climatic and atmospheric effects.

For example, items like overhead tanks, furniture steel structures, cable insulations, chemicals,-vessels, etc., are subjected to climatic and atmospheric effects, which reduces their strength, serviceability and value. This reduction in value *is depreciation due to physical decay*.

56. What do you mean by Depreciation due to Accident?

We know that inspite of a number of precautionary measures, sometimes accidents may occur in the industry due to fire hazard, facility operations, *etc.* This may cause damage to the machines, plant, building, vehicles or such other fixed assets.

The loss in the value of the asset mainly due to undesirable, uncontrollable and unforeseen accidents is" known as *depreciation due to accidents*.

Now-a-days, to' cover this loss, most of.the equipments, assets are insured with the insurance companies.

57. Define Depreciation due to 'Deferred maintenance and neglect'

Usually all manufacturers supply instructions manuals along With the machines, equipments, *etc.*, supplied by them. These manuals contain important instructions for the smooth and efficient runing,of an equipment.

If these instructions are not followed in time due to negligence or any other reason, the efficiency and the value of the machine gradually decreases.

The loss in the value of the machine due to poor maintenance and neglect is known as *depreciation due to deferred maintenance*.

58. Define Inadequacy

Sometimes the existing machine is functioning well, but it is not capable to cope-up with the increased demand. Because of the increased demand, that particular machine becomes inadequate.

For example, an existing pit furnace replaced by a cupola furnace to meet the increased demand.

Therefore additional money, should be spent either to replace the machine or to install more similar size machines.

This type of depreciation where a machine is to be replaced while it is functioning is known as *depreciation by inadequacy*.

59. Define Depreciation by Obsolescence

Because of technological advancement, everyday the design, functional features, costs, etc., of machines become better and better. To withstand in the market competition, the company should buy the better designed new machines which forces the existing machines to become obsolete.

This type of, depreciation when a functioning machine is to be sold out or scraped because of the invention of better machine making the existing one obsolete is known as *depreciation by obsolescence*.

60. What are the methods of depreciation?

Straight line method.
Diminishing balance (or reducing balance method.)
Sinking fund method.
Annuity method.
Sum of year's digits method.
Insurance policy method.
machine-hour method.
Production-unit method.
Revaluation (or regular valuation) method-
Retirement method.

UNIT-IV

1. Define Machine or Upset Forging

Unlike the drop or press forging where the material is drawn out, in machine forging, the material is only upset, to get the desired shape.

The heated bar stock is held between two dies and the protruding end is hammered using another die.

In upset forging, the cross section of the metal is increased with a corresponding reduction in its length.

This method is used for making gear blanks, shafts, axles and similar parts.

2. Write the forging operations.

1. Upsetting

Upsetting is the process of increasing the thickness or the cross-sectional area of the work piece by reducing its length.

2. Drawing Down (Fullering)

Drawing down is a process of increasing the length of a bar and reducing its thickness or width.

3. Setting Down

This is an operation which usually follows drawing down. This operation can be performed with a hammer and a flatter.

4. Bending

Bending is the operation by which a metal rod or pipe can be bent to form various shapes without damaging its internal grain structure.

5. punching

Punching is the process of producing holes in a workpiece.

6. Drifting

After a hole is punched, it may be opened out to any size and shape by driving a tapered drift through it. This operation is known as drifting.

7. Swaging

Swaging is the process of removing the irregularities on the surface of the workpiece produced by the process of drawing down.

3, Define Shear Loss

The blank required for forging a component is cut from billets or long bars, by means of, a sawing machine. During sawing, the material equal to the product of thickness of sawing blade and cross-section of bar is lost for each cut. This material loss is known as shear loss.

Similarly the end of the billet, pieces of smaller dimensions are mostly left. These material lost are also included with shear loss.

Shear loss is generally taken as 5% of the net weight.

4. Define Tonghold Loss

While performing some forging operations, some length of the stock (at one end) is required for holding the stock in tong. This small extra length will be removed after completion of the workpiece. This losses known as *tonghold loss* Therefore this tonghold loss should be added while calculating the required stock material.

Length of tonghold is generally taken as 2 to 2.5 cm of the stock length.

5. Define Scale Loss

As the workpiece is heated at high temperature during the forging processes, the oxidation of the outer surface of the workpiece will take place. That is, the heated workpiece reacts with oxygen from air forms a thin film of iron oxide on the outer surface of the workpiece.

This thin film of iron oxide is called scale. When hammering is done, the scale is broken and falls down as a waste. This material waste is known as scale loss

Generally scale loss is taken as 6% of the net weight

6. Define Flash Loss

When dies are used for forging, certain quantity of material comes out of the die at the parting line of the top and bottom halves of the die. This surplus wastage material is called flash.

Flash is generally taken as 20 mm wide and 3 mm thick.

7. Define Sprue Loss

The portion of metal between the length held in the tong (i.e., tonghold) and the material in the die is called *sprue* or *runner*. This is cut off when workpiece is completed.

The material loss due to this portion of the material used as a contact is called *sprue loss*. The sprue must be heavy enough to permit lifting the workpiece out of the impression die without bending.

The sprue loss is generally taken as 7% of the net weight.