



Department of Mechanical Engineering

## IMPORTANT QUESTIONS AND ANSWERS

### Part- A

#### 1. What is meant by Break-even analysis? (M/J-16, N/D-15, M/J-15)

Break analysis is used to determine when your business will be able to cover all its expenses and begin to make a profit. It is important to identify your startup costs, which will help you determine your sales revenue needed to pay ongoing business expenses.

#### 2. What are objectives of production Planning?(N/D-15)

- To achieve coordination among various departments relating to production
- To make adequate arrangement of men, money, materials, machine tools, implements and equipment relating to production.
- To keep production operation continuous.

#### 3. List the objectives of planning and control.(M/J-15)

- To plan production facilities in the best possible manner along with the proper systematic planning of production activities.
- Providing men, machines, materials etc. of right quality, quantity and also providing them at the right time forms a very important factor.
- To inform, about the difficulties or the various awkward positions expected to crop up later, to the management beforehand.

#### 4. What are functions of production control? (M/J-14)

**Function of production control are:**

- Activity of monitoring and controlling any particular production or operation.

- Production control is often run from a specific control room or operations room.

5. **Define standardization and specialization of product.** (N/D-14,N/D-13, M/J-12)

**Standardisation:**

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

**Specialization:**

Specialization is the process whereby particular firms concentrate on the manufacture of a limited number of products or types of products

6. **Define method study.** (M/J-16, M/J-15)

**Method Study:**

Method study is the systematic recording and critical examination of existing and proposed ways of doing work, as a means of developing and applying easier and more effective methods and reducing costs.

7. **What is work measurement?** (M/J-16)

Work measurement is the application of techniques designed to establish the time for a qualified worker to carry out a specified job at a defined level of performance.

8. **Bring out the meaning of the term therbligs.** (N/D-15)

Therbligs are the symbols used to denote the various activities and movements done for different purposes.

Abbreviation	Symbol	Name of symbol	Abbreviation	Symbol	Name of symbol
<i>Sh</i>		SEARCH	<i>I</i>		INSPECT
<i>F</i>		FIND	<i>PP</i>		PRE-POSITION
<i>Sl</i>		SELECT	<i>RL</i>		RELEASE LOAD
<i>G</i>		GRASP	<i>TE</i>		TRANSPORT EMPTY
<i>TL</i>		TRANSPORT LOADED	<i>R</i>		REST FOR OVERCOMING FATIGUE
<i>P</i>		POSITION	<i>UD</i>		UNAVOIDABLE DELAY
<i>A</i>		ASSEMBLE	<i>AD</i>		AVOIDABLE DELAY
<i>U</i>		USE	<i>Pn</i>		PLAN
<i>DA</i>		DISASSEMBLE	<i>H</i>		HOLD

**9. List out the various techniques of work measurement. (N/D-15)**

- Stop watch time study
- Work sampling
- Predetermined time standards (PTS)
- Standard data.

**10. Mention any two tools used in time study. (M/J-15)**

- Stop watch
- Electronic devices
- Motion picture camera
- Time study board
- Calculators, scale, tape..etc

**11. List the pre-requisite information needed for process planning. (M/J-16, N/D-13)**

- Assembly and component drawings and bill of materials
- Machine and equipment details:
  - ❖ The various possible operations that can be performed
  - ❖ The maximum and minimum dimensions that can be machined on the machines
  - ❖ The accuracy of the dimensions that can be obtained
  - ❖ Available feeds and speeds on the machine.
- Availability of machines, equipment's and tools.

**12. How is the quantity determined in batch production? (M/J-16)**

The minimum cost batch size can be obtained from the expression

$$Q_m = \sqrt{\frac{2 d S}{I (1+\gamma) + 2 B}}$$

Where d = demand rate,

S = set up cost,

I = carrying cost, Y = demant rate and B = Storage cost

**13. Define the term process capability. (N/D-15)**

Process capability is the ability of the combination of people, machine, methods, materials and measurements to produce a product that will consistently meet the design requirements or customer expectation.

The purpose of a process capability study is to compare the process specification to the process output and determine statistically if the process can meet the customers specifications.

**14. What are objectives of value analysis? (N/D-15)**

- ❖ To provide better value to the product
- ❖ To improve the company competitive position
- ❖ To eliminate unnecessary cost
- ❖ New product and product design

**15. What is value analysis? (M/J-15, M/J-12, N/D-14)**

Value analysis is disciplined approaches that ensure the necessary functions at minimum cost without comprising on quality, reliability, performance and appearance.

**16. Define Kanban system. (M/J-16, M/J-15)**

- ❖ Kanban is a scheduling system that pulls production based on actual demand.
- ❖ Kanban controls the timing and quantity, as well as the precise item to be produced.

**17. What is manufacturing lead time? (M/J-16, M/J-14)**

- ❖ Lead time is the gap between placement of an order and the actual supply in time.
- ❖ It does not need to be identical to delivery time.

**18. Differentiate between sequencing and scheduling. (N/D-15)****Scheduling:**

- ❖ Scheduling refers to the setting of operation start dates so that job will be completed by their due date.
- ❖ The allocation of resources over time to accomplish specific tasks.

- ❖ To determine the sequence in which operations are to be performed within the available capacity.

**Sequencing:**

- ❖ Product sequencing is a systematic procedure for assigning priorities to waiting jobs thereby determining the sequence in which the jobs will be performed.
- ❖ First come, First served, Shortest operating time, Earliest due date first..etc

**19. Cite the meaning of the term line of balance. (N/D-15)**

Line of Balance is a charting technique that uses lead times and assembling sequencing to compare planned component completions with actual component completions.

**20. What are Gantt charts? (M/J-15)**

Gantt charts are visual aids used to depict the sequencing, load on facilities, or progress associated with work effort over a well-defined time period.

**21. Write the uses of two bin system? (M/J-16)**

The spare bin allows for the uncertainty in supply, use and transport that are inherent in the system.

**22. What is ABC analysis? (M/J-16, N/D-15)**

ABC analysis is based on the pareto to principle that a few high usage value items constitute a major part of the capital invested in inventories whereas bulk of inventory items having low usage value constitute insignificant part of the capital.

**23. List out the various elements of JIT systems. (N/D-15)**

- i. Technology management
- ii. People management
- iii. Systems management

**24. What is MRP-II. (M/J-15)**

Manufacturing Resource Planning is an integrated information system that synchronizes all aspects of the business.

MRP II system coordinates sales, purchasing, manufacturing, finance and engineering by adopting a focal production plan and by using one unified database to plan and update the activities in all the system.

**PART – B****1. Discuss in detail about the various functions of production and planning control. (M/J-16, N/D-15, M/J-12)**

The importance or functions of production planning and control:

- i. Utilizes resources effectively.
- ii. Makes flow of production steady.
- iii. Estimates production resources.
- iv. Maintains necessary stock levels.
- v. Coordinates departmental activities.
- vi. Minimizes wastage of resources.
- vii. Improves labor efficiency.
- viii. Helps to face competition.
- ix. Provides better work environment.
- x. Facilitates quality improvement.
- xi. Customer satisfaction.
- xii. Reduces production costs.

Now let's discuss above listed functions of production planning and control.

**i. Utilizes resources effectively.**

- Production planning and control result in effective utilization of plant capacity, equipment and resources.
- It results in low-cost and high-returns for the organization.

**ii. Makes flow of production steady.**

- Production planning and control ensure a regular and steady flow of production.
- All machines are put to their optimum use.
- This helps in achieving a continuous production of goods.
- This also helps to provide a regular supply of goods to consumers.

**iii. Estimates production resources.**

- Production planning and control help to estimate the resources like men, materials, machines, etc.
- The estimate is made based on sales forecast.
- So, production is planned to meet sales requirements.

**iv. Maintains necessary stock levels.**

- Production planning and control prevent over-stocking and under-stocking of materials.
- Necessary stocks are maintained.
- Stock of raw-material is maintained at a proper level in order to meet production demands.
- Stock of finished goods is also maintained to meet regular demands from customers.

**v. Coordinates departmental activities.**

- Production planning and control helps to co-ordinate the activities of different departments.
- Consider, for an example, the marketing department co-ordinates with production department to sell the goods.
- This results in profit to the organization.

**vi. Minimizes wastage of resources.**

- Production planning and control ensure proper inventory of raw-materials and effective handling of materials.
- This helps to minimize the wastage of raw materials.

- It also ensures production of quality goods. This results in minimal rejects.
  - So, it results in minimum wastage.
- vii. Improves labor efficiency.**
- There is maximum utilization of manpower.
  - Training is provided to the workers.
  - The profits are shared with the workers in form of increased wages and other incentives.
  - Workers are motivated to perform their best. This results in improved labor efficiency.
- viii. Helps to face competition.**
- Production planning and control help to give delivery of goods to customers in time.
  - This is because of regular flow of quality production.
  - So, the company can face competition effectively, and it can capture the market.
- ix. Provides better work environment.**
- Production planning and control provide a better work environment to workers.
  - They get better work facilities, proper working hours, leave and holidays, increased wages and other incentives.
- x. Facilitates quality improvement.**
- Production planning and control facilitate quality improvement because the production is checked regularly.
  - Quality consciousness is developed among the employees through training, suggestion schemes, quality circles, etc.
- xi. Customer satisfaction.**
- Production planning and control help to give a regular supply of goods and services to consumers at competitive market price.

- This results in customer satisfaction.
- xii. Reduces production costs.**
- Production planning and control make optimum utilization of resources, and it minimizes wastage.
  - It also maintains an optimal level of inventories.
  - Overall, this reduces the production costs.
2. Explain in detail the various aspects of product development and design.  
(M/J-16,N/D-15, M/J-15, M/J-14, N/D-13, M/J-12)
3. Write short notes on the following (M/J-16, M/J-15, M/J-12)
- (i) Mircromotion study
  - (ii) Memomotion study
4. Explain briefly the following techniques of work measurement (M/J-16, N/D-15, N/D-13, M/J-12)
- i. Time study
  - ii. Production study
  - iii. Work sampling

### **Time Study:**

Time study is a direct and continuous observation of a task, using a timekeeping device (e.g., decimal minute stopwatch, computer-assisted electronic stopwatch, and videotape camera) to record the time taken to accomplish a task and it is often used when

- there are repetitive work cycles of short to long duration,
- wide variety of dissimilar work is performed, or
- process control elements constitute a part of the cycle.

### **Objectives of Time Study:**

The main objectives of time study are the followings:

- i. Target time for each job can be scientifically estimated. With this estimate realistic schedules and manpower requirements can be prepared.
- ii. Sound comparison of alternative methods is possible by comparing their basic times.
- iii. Useful wage incentive schemes can be formulated on the basis of target times.

**Basic procedure for time study:**

- ❖ Select the job for study and define the objective of the study. This needs statement of the use of results, precision required and the desired level of confidence in the estimated time standards.
- ❖ Analyse the operation to determine if the standard method and conditions exist and the worker is properly trained. The method study or training of operator should be completed before starting time study if need be.
- ❖ Select the operator to be studied if more than one can perform the task.
- ❖ Record the information about the standard method, operator, operation, product machine, quality required and working conditions.
- ❖ Divide the operation into reasonably small elements.
- ❖ Time the operator for each of the elements. Estimate the total number of observations to be taken.
- ❖ Collect and record the data of required number of cycles by way of timing and rating the operator.
- ❖ For each element of operation note the representative watch time and calculate the normal time as follows: Normal Time = Observed time x Rating Factor
- ❖ Calculate normal time for the whole job by adding normal time of various elements.
- ❖ Determine standard time by adding allowances to normal time of operation. Some allowances such as personal allowance (20%), fatigue allowance (5%)

preparation allowance (5%) are generally used or these can be taken from the company's policy book or by conducting an independent study.

Thus standard time = Normal time + Allowances

### **Work sampling:**

Work sampling is the statistical technique for determining the proportion of time spent by workers in various defined categories of activity (e.g. setting up a machine, assembling two parts, idle...etc.)

### **Objectives of Work Sampling:**

Work sampling is a fact finding tool and has the following two main objectives:

- i. To measure activities and delays while a man is working and percentage of that he is not working. It means a fair day's work.
- ii. Under certain circumstances, to measure manual tasks that is to establish time standards for an operation.

### **Procedure for Work Sampling Study:**

The following steps are involved in making a "Work Sampling" study:

- i. Define the Problem.
  - State the main objectives or purpose of the problem.
  - Describe the details of each element to be measured.
- ii. Obtain the approval of the incharge of the department in which study is to be made. Obtain the co-operation of the operators to be studied and they should also understand the purpose of study.
- iii. Determine the desired accuracy of the final results in the form of standard error or percentage.
- iv. State the confidence level.
- v. Make a preliminary estimate of the percentage occurrence of the activity or delay to be measured for one day or two days. This may be estimated on the basis of past experience.
- vi. a. Design the study.

Determine the number of:

- (i) Observations to be made.

- (ii) Observations needed. Select and instruct them.
- (iii) Days or shifts needed for the study.
- (b) Make plans for taking the observations such as time for taking and the route to be followed by the observer.
- (c) Design the observations form.
  - vii. Make the observations and record the data.
  - viii. Summarize the data at the end of the each day.
  - ix. Check the accuracy or precision of the data at the end of the study.
  - x. Prepare the report and state results. If required make recommendations.

**5. Briefly discuss about the approaches to process planning. (M/J-16, M/J-14)**

**Process planning :**

Process planning can also be defined as the systematic determination of the methods by which a product is to be manufactured economically and competitively. It consists of devising, selecting and specifying processes, machine tools and other equipment to convert raw material into finished and assembled products.

**APPROACHES OF PROCESS PLANNING**

**Manual Process Planning**

This type of planning is known as non-variant process planning. It is the commonest type of planning used for production today. Planning the operations to be used to produce a part requires knowledge of two groups of variables.

- (a) The part requirements, and
- (b) The available machines and processes and the capabilities of each process.

The steps mentioned in the previous section are essentially same for manual process planning. Following difficulties are associated with manual experienced based process planning method :

- It is time consuming and over a period of time, plan developed are not consistent.
- Feasibility of process planning is dependent on many upstream factors (design and availability of machine tools). Downstream manufacturing activities such as scheduling and machine tool allocation are also influenced by such process plan. Therefore, in order to generate a proper process plan, the process planner must have sufficient knowledge and experience. Hence, it is very difficult to develop the skill of the successful process planner and also a time consuming issue.

### **Computer Aided Process Planning**

Computer Aided Process Planning (CAPP) has been investigated for more than 20 years; it can be categorized in two major areas; variant planning, where library retrieval procedures are applied to find standard plans for similar components, and generative process planning, where plans are generated automatically for new components without reference to existing plans. The latter system is most desirable but also the most difficult way of performing CAPP.

Computer-aided process planning (CAPP) helps determine the processing steps required to make a part after CAP has been used to define what is to be made. CAPP programs develop a process plan or route sheet by following either a variant or a generative approach. The variant approach uses a file of standard process plans to retrieve the best plan in the file after reviewing the design.

The plan can then be revised manually if it is not totally appropriate. The generative approach to CAPP starts with the product design specifications and can generate a detailed process plan complete with machine settings. CAPP systems use design algorithms, a file of machine characteristics, and decision logic to build the plans. Expert systems are based on decision rules and have been used in some generative CAPP systems.

CAPP has recently emerged as the most critical link to integrated CAD/CAM system into inter-organizational flow. Main focus is to optimize the system performance in a global context. The essentiality of computer can easily be understood by taking an example, e.g. if we change the design, we must be able to fall back on a module of CAPP to generate cost estimates for these design changes. Similarly for the case of the breakdown of machines on shop floor. In this case, alternative process plan must be in hand so that the most economical solution for the situation can be adopted. Figure is one such representation, where setting of multitude of interaction among various functions of an organization and dynamic changes that takes place in these sub functional areas have been shown. Hence, the use of computer in process planning is essential.

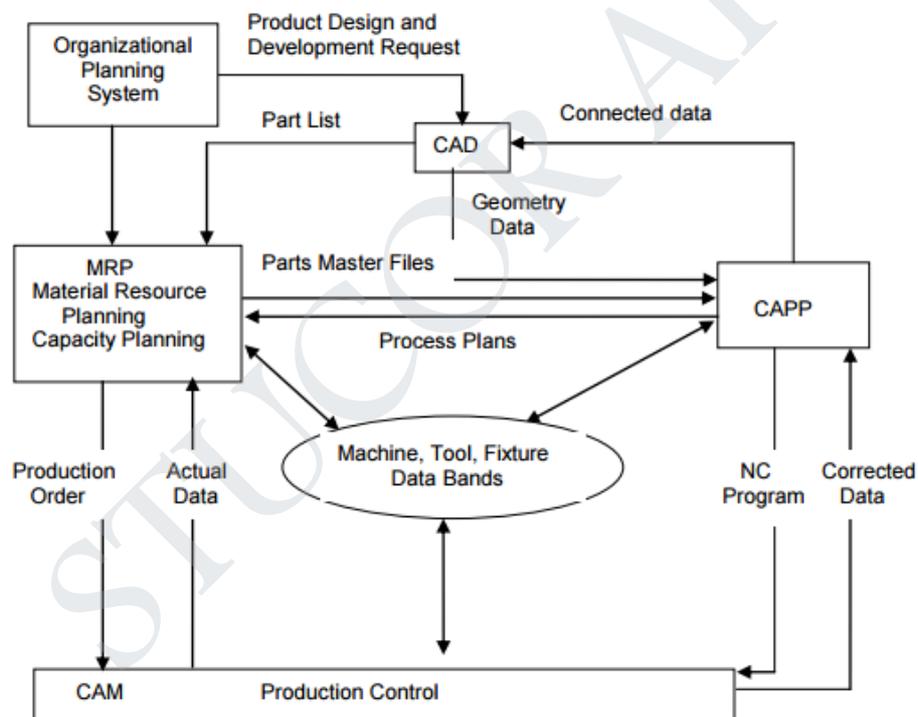


Figure 9.2 : Framework for Computer Aided Process Planning

CAPP is the application of computer to assist the human process planner in the process planning function. In its lowest form it will reduce the time and effort required to prepare process plans and provide more consistent process plan. In its most advanced state, it will provide the automated interface between CAD and CAM and in the process achieve the complete integration within CAD/CAM.

## 6. Explain various methods of line balancing. (M/J-16, N/D-14)

### LINE OF BALANCE:

Its a charting technique that uses lead times & assembling sequencing to compare planned component completions with actual component completions.

Its used in production scheduling & contro to find:

- How many items should have been completed by review date
- How many should have passed through the previous operation stages by the review date so as to ensure the completion of the required delivey schedule.

### Uses:

LOB permits scheduling the following activities simultaneously on one chart:

- Source of each component element
- Sequence of assembly, including sub assembly, testing & inspection
- Comparison of scheduled versus actual finished product deliveries

### Input to LOB:

- Schedule of delivery
- Key operations in making the product with need to be controlled
- The sequence in which the key events are connected
- Lead times of these events

### Various charts used in LOB:

- Operation programme chart/assembly chart
- Objective chart
- Progress chart &
- Line of balance chart.

**Operation programme chart;**

This chart is also known as Program plan or production lead time chart or assembly chart

This network like event-oriented charts indicate:

- Latest start time of any operation
- Date by which it must be completed
- The delivery lead time for the end item is zero
- The time scale indicates the lead time

**Objective chart:**

The objective chart shows the contrast b/w expected completion schedule of production and actual performance.

**Objective chart shows:**

- The difference b/w the schedule and actual deliveries.
- The time lag b/w the schedule and actual deliveries
- The schedule of actual deliveries is drawn on the same objective chart as the contract schedule.

**Line of balance chart:**

The line of balance chart the quantity of item that have been completed at each operation stage in particular time at which progress will be reviewed.

**Construction procedure:**

Step 1: Draw the cumulative completion schedule graph

Step 2: Draw the vertical line AB on the cumulative completion graph

Step 3: Draw the LOB schedule on R.H.S of cumulative completion graph

Step 4: For each of other operation stages, find out how many have been completed

Step 5: Draw the LOB by joining the top of vertical bars for each operation chart.

**PROGRESS CHART:**

- This is a bar type chart which shows the actual no of items produced at each operation stage.
- This chart indicates excess or shortage in quantities
- If the LOB line higher than progress chart , the scheduled is taken as delayed.

## 7. Explain ABC analysis in detail.(M/J-16, N/D-14, M/J-14, M/J-12)

### ABC Analysis:

ABC Analysis is the basic method of stock control generally used in a medium size company. Inventory in a to execute proper control it is necessary to take selective approach & find out the attention required for each type of item, according to its importance.

In relation to the inventory control the curve demonstrates the 'law' that a small proportion of the stocked item accounts for a large proportion of inventory cost or value. Their relationship is often referred to as 80/20 'law' i.e., up to 80% of firm's total inventory cost or value is accounted by about 20 % types of encourage categories various types of inventory items in to three classes viz. A, B & C.

#### Class 'A' :

Those relatively few types of items ( upto 20% )

Age of total cost ( upto 80% )

#### Class 'B' :

Slightly larger no of types of items ( upto 30% ) which account percentage of total cost ( upto 15% )

#### Class 'C' :

That large no. of types of items which account for a very small (up to 5%) of total cost. In this analysis, priority is determined by the money

value of the importance of the item. Hence class 'A' items need to be very closely controlled by the management analysis can be referred as the basic analytical material management tool.

### EXAMPLE OF A CLOTHING:

#### WHOLE SELLER, FOR ABC ANALYSIS

The table below shows the bought in prices & annual sales of the set of different types of garments which are held in stock by a whole seller. Construct an ABC chart for these items & suggest which items should be treated as class A, B, & C.

Item Type ( Items/Yr )	Purchase price (Rs.)	Annual sales
A	8	1250
B	18	450
C	30	75
D	25	10
E	3	280
F	4	080
G	18	45
H	7	250
I	12	150
J	26	30

*Solution :*

#### Calculation of Annual Value ( Step I )

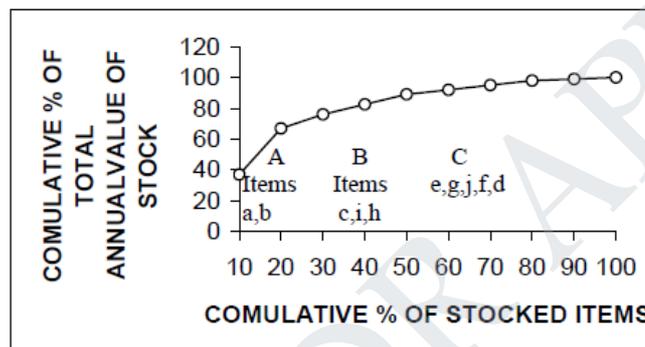
Items	A	B	C	D	E	F	G	H	I	J	10
Annual Values or uses	10000	8100	2250	250	340	320	810	1750	1800	780	26900

Where, 10 – the column is total annual value.

Order items by descending annual values & calculate common annual value (Step II)

ITEM TYPE	ANNUAL VALUE	CUMULATIVE % (OF 26000)	CLASS
A	10,000	37	A
B	8,100	67	A
C	2,250	76	B
I	1,800	82.5	B
H	1750	89	B
E	840	92	C

G	810	95	C
J	780	98	C
F	320	99	C
D	250	100	C



**SUMMARY ( STEP IV)**

CLASS	ITEMS	% ITEMS	ANNUAL VALUE OF CLASS	% OF ANNUAL VALUE
A	a,b,	20	18,100	@ 67
B	e,i,b	30	5,800	@ 20.5
C	e,g,j,f,d	50	3,000	@ 12.5

**CONCLUSION:**

It is evident from the discussion that to have an healthy organization the pre planning and post-planning activities are to be ground property at the initial stage turning organization, after preplanning the links are connected with PPC department planning, evaluation, adjustment, feedback and overall control. Ten functions of PPC as if ten Commandments to be followed in any manufacturing industry. Depending upon the nature of production and size of unit, these functions are glooming in determination position and when required.