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Types of Production :- This is one factor which influences the type of plant layout the most.

A) Continuous Production :- It involves a continuous or almost continuous physical flow of material. It makes use of special purpose machines, and produces standardized items in large quantities.

ex:- chemical processing, cigarette and cement manufacturing etc. of two types :-

1) Mass & flow Line production :- Characterized by high volume and low variety. This manufactures several standard products produced and stocked in the warehouses as finished goods awaiting to be despatched.

In mass production the production cycle involves one or more operations on the raw material on one machine.

ex:- nails, screws, nut-bolt, plastic can and bottles etc

In flow production the production cycle involves operations on the raw materials

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on more than one machine, this product flows in continuous stages from process to process.

ex:- T.V sets, air conditioners, motor cycles etc.

Characteristics of mass and flow production are:

- 1) High volume and low variety.
- 2) Flow of material is continuous.
- 3) Material handling is mechanised.
- 4) Lower in-process inventory.
- 5) Special purpose machines (SPM) having higher production capabilities and output rates.
- 6) Shorter cycle time.
- 7) Work in process is low because of line balancing.
- 8) Less flexibility of equipment and machines.
- 9) Lower skilled person can manage work.
- 10) Because of high volume, cost per unit is low.

ii) Continuous or process production:- is used where the product consumes fast (electricity, petrol, chemicals etc.) and has continuous demand.

Process industries add value by mixing, separating, forming and/or performing chemical reactions. It may be carried out in either batch or continuous mode.

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ex:- petroleum product, chemicals, fertilizers, rubber paint etc.

### Characteristic of Continuous or Process Production:-

- 1) Dedicated plant & equipments with zero flexibility.
- 2) fully automatic material handling.
- 3) Shorter lead times.
- 4) Wet or dry product flow measurable by weight or volume.
- 5) Process follows a predetermined sequence of operations.
- 6) Unit cost lower due to high volumes.
- 7) Semi-skilled labourers can be employed.
- 8) Planning & scheduling is a routine action.

3) Intermittent Production System:- It involves intermittent or interrupted flow of material through the plant. It makes use of general purpose machines and produces components different in nature and in small quantities.

ex:- Machine shops, repair and maintenance shops, welding shops etc.

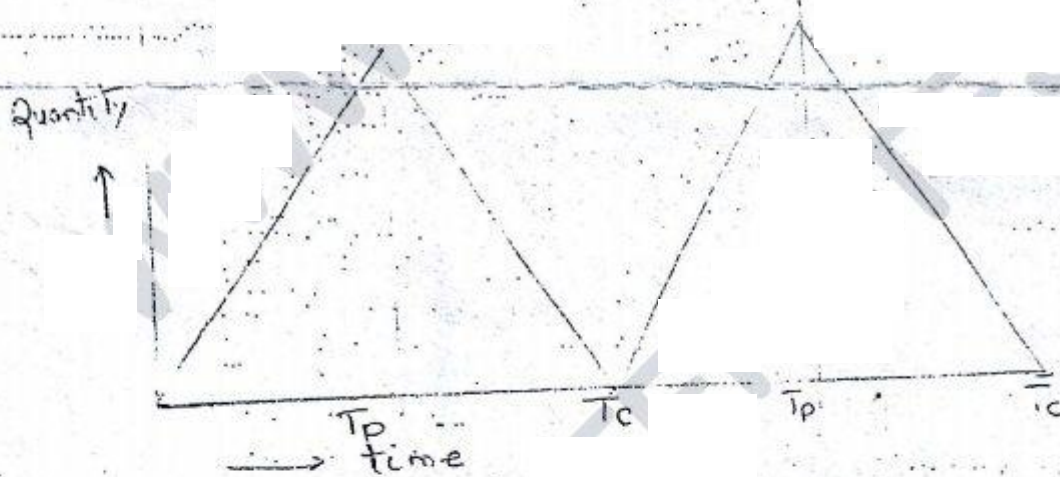
of two types:-

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i) Batch Production :- Batch production is characterized by the manufacture of limited number of products produced at regular intervals and stocked awaiting sales.

Batch production is justified when the production rate exceeds the demand rate. The quantities in batch production are decided based on the balancing of two costs, i.e. setup cost and inventory carrying cost.

$T_p$  = production period  
 $T_c$  = consumption period



Characteristic of Batch production :-

- 1) Shorter production runs.
- 2) Articles are manufactured in batches or lots as per the orders.
- 3) Plant and machinery are flexible.

- 4). Higher level of work in process inventory.
- 5). Supervision required is more than mass but less than job order.
- 6). More number of setups and hence higher set up cost.
- 7). Division of Labour, is possible.
- 8). Material flow is intermittent.
- 9). Flexible material handling system.

i) Job Order production :- Manufacturing of one or few quantities of products designed and produced as per the specifications of the customers within the prefixed time and cost. This type of production is distinguished by high variety and low volume.

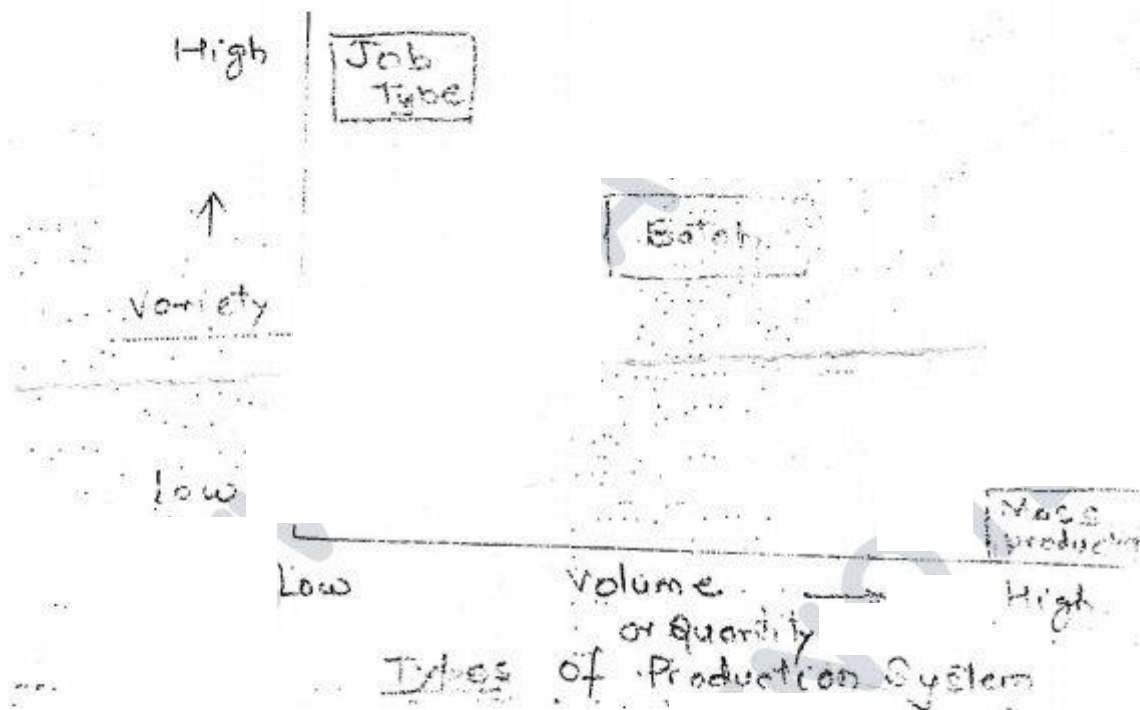
Ex :- Space vehicle, custom clothing, aircraft, construction equipments etc.

Characteristics of Job order production :-

- High variety of product and low volume.
- Use of general purpose machines and facilities.
- Highly skilled operators.
- Frequently changing setups.
- Flow of material is intermittent or discontinuous.

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- 6). Very large work-in process inventory.
- 7). Manufacturing cycle time is more.
- 8). Flexible material handling system.
- 9). Product design takes a lot of time.
- 10). Prior planning becomes difficult.
- 11). Because of higher variety, scheduling becomes complicate



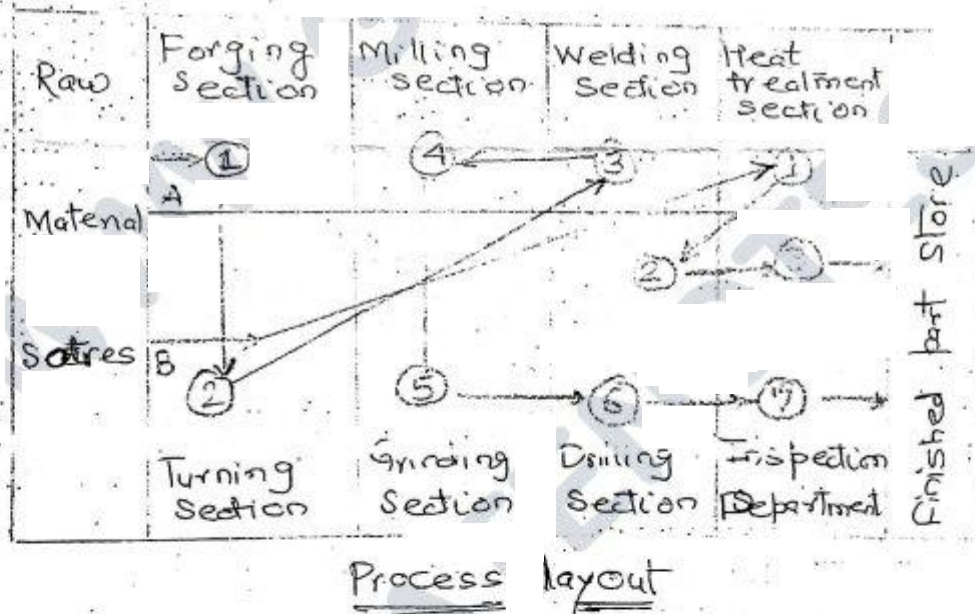
## Types of Plant layout :-

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### a) Functional or Process layout :-

If the machines are arranged according to the nature or type of operations, it is called process layout. All machines performing similar type of operations are grouped at one location in the process layout e.g. all lathes in one section, all drilling machines in other etc.

This layout is recommended for Job type or batch type production system.



### Advantages :-

- 1) **Flexibility** of equipment and personnel.
- 2) **Lower investment** or account of comparatively less number of machines and lower cost of general purpose machines.

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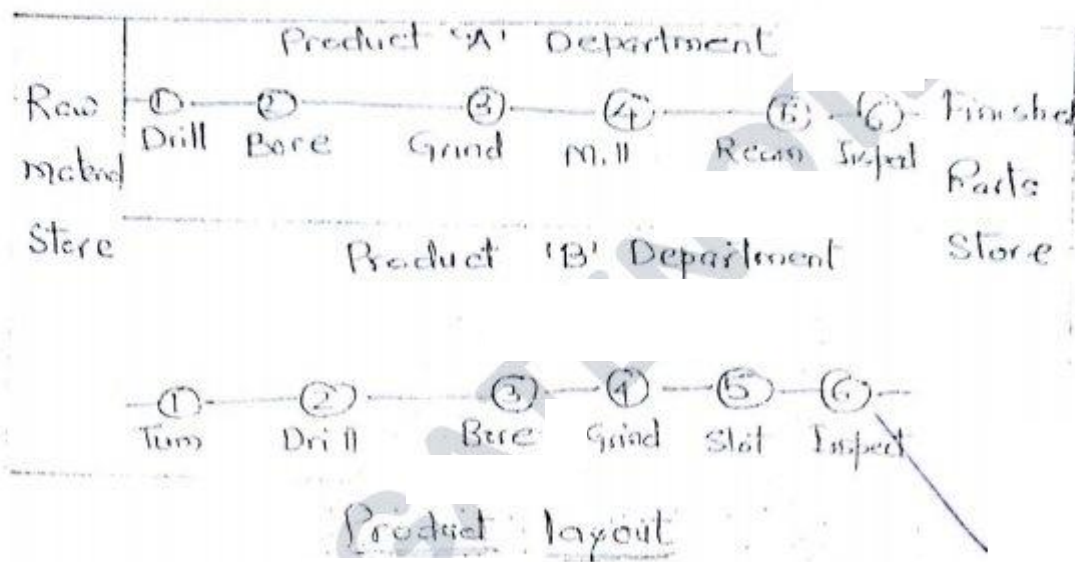
- 3). Higher utilisation of production facilities.
- 4). Variety of Jobs makes the Job challenging and interesting
- ★ 5). Workers in one section are not affected by the nature of the operations carried out in another section.
- 6). Better product quality.

### Disadvantages :-

- 1) Back tracking and long movements may occur in the handling of materials thus reducing material handling efficiency.
- 2) More space required in comparison to product layout.
- 3). Production control becomes difficult
- 4). Work-in process inventory is large.
- 5). Automatic material handling is difficult.
- 6). Needs more inspection and efficient co-ordination.

b). Product or line layout :- If the machines and processing equipments are arranged according to the sequence of operation of a product, the layout is called product layout. This type of layout is done to manufacture one type of product in large quantity. Special purpose machines are used which

perform the required function quickly and reliably.  
 Separate layouts are necessary for different types of products.



### Advantages :-

- 1) Reduce material handling cost due to mechanised handling systems and straight flow.
- 2) Less space requirement for same volume of production.
- 3) Less in-process inventory
- 4) Simplified production planning and control.
- 5) Unskilled workers can manage the production.
- 6) Smooth and continuous work flow.
- 7) Product completes in lesser time.

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Disadvantages:-

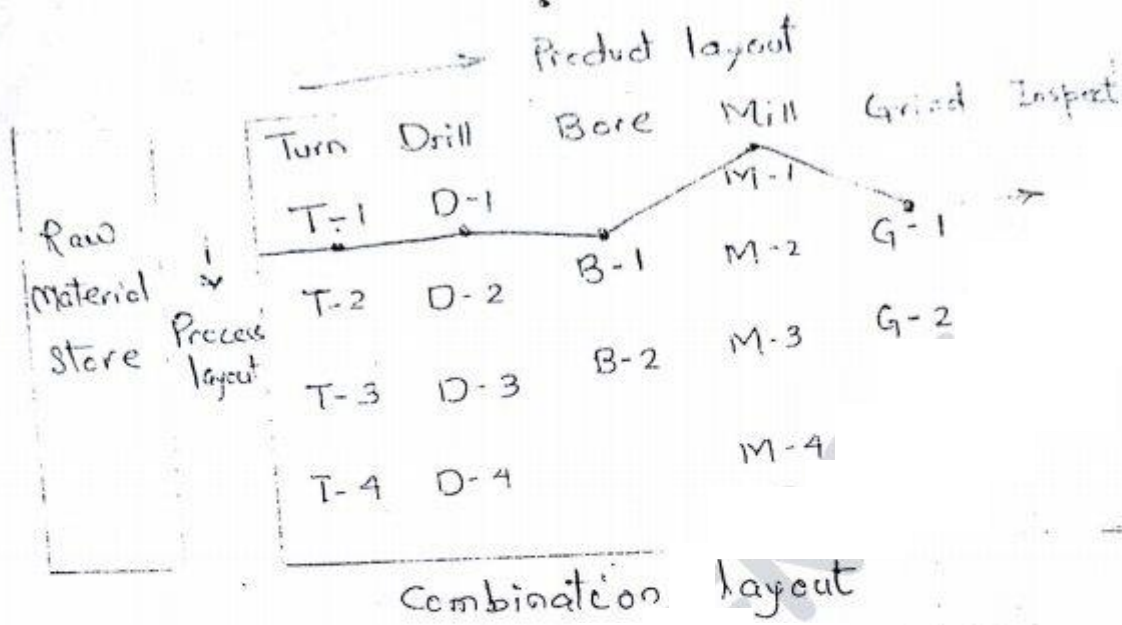
- 1) Lack of layout flexibility.
- 2) Large capital investment.
- 3) If one machine in the line fails, it may lead to shut down of the complete production line.
- 4) Pace or rate of work depends upon the output rate of the slowest machine, if production line not properly balanced.
- 5) Dedicated or special purpose machines means high Investment.

C). Combination, hybrid or mixed type layout:- A

A combination of process and product layout combines the advantages of both types of layouts. For example T.V, refrigerator, music system etc. uses a combination layout. The process layout is used to produce different parts in various operations like stamping, welding, machining, heat treatment etc. The final assembly of the product is done in product type layout.

Thus for manufacturing various components parts process layout is used and for assembly product layout is used.

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d) Fixed position layout :- In this type of layout, the material or major components remain in a fixed location and tools, machinery, men and other materials are brought to this location.

In other types of layout, the product moves past stationary production equipment, whereas in this case the reverse applies; men and equipment are moved to the material, which remains at one place and the product is completed at that place where the material lies.

ex:- Ship building, air craft manufacturing, etc.

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### Advantages:-

- 1). It involves least movement of material
- 2) Maximum flexibility for all sorts of changes in product & process.
- 3). Layout capital investment is lower.
- 4) A number of quite different projects can be taken with the same layout
- 5). Possible to assign one or more skilled workers to a project from start to finish in order to ensure continuity of work.

### Disadvantages:-

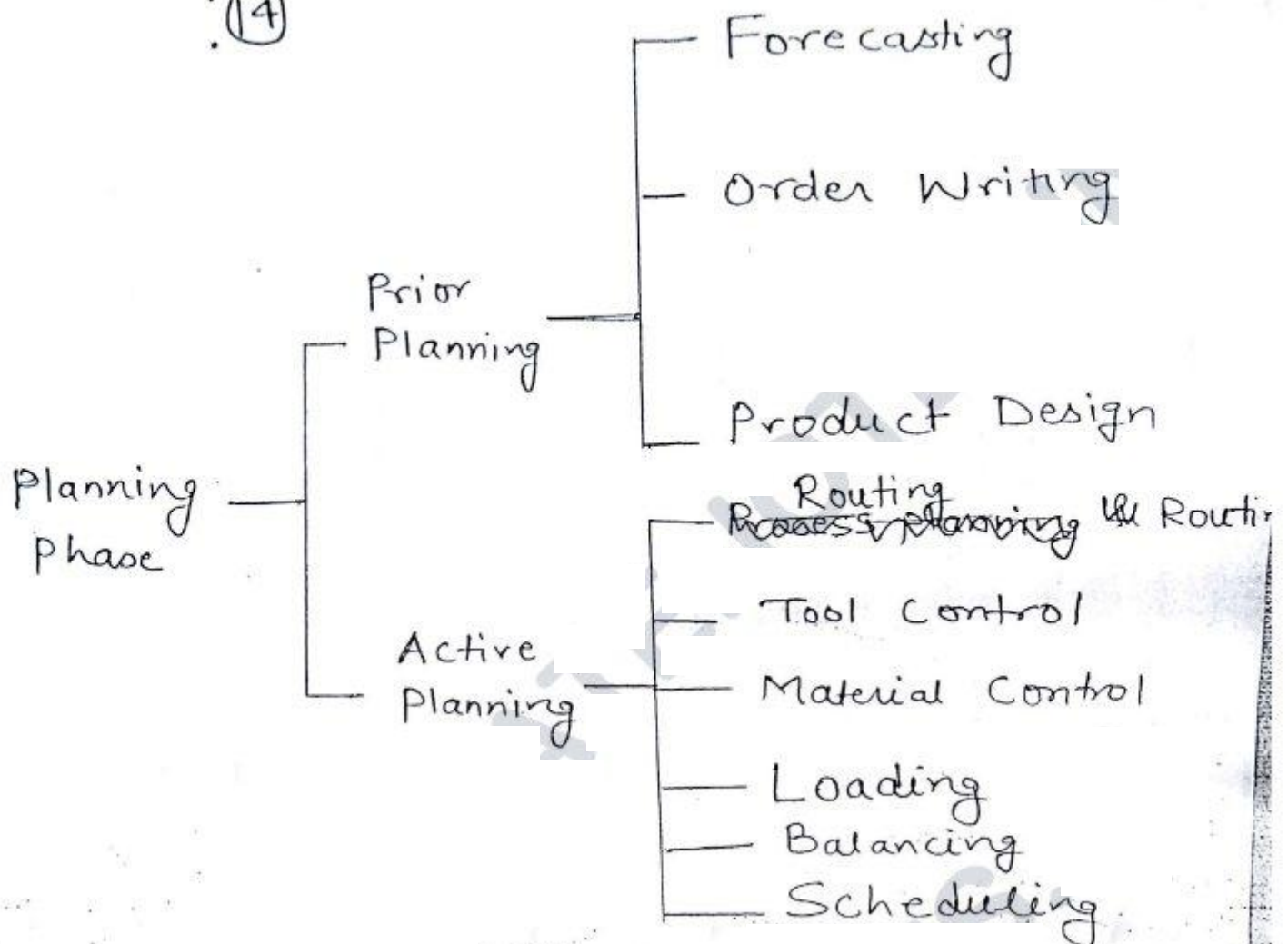
- 1). Usually low content of work-in-progress.
- 2) low utilization of labour and equipment.
- 3). It involves high equipment handling cost.

## Production Planning & Control (13)

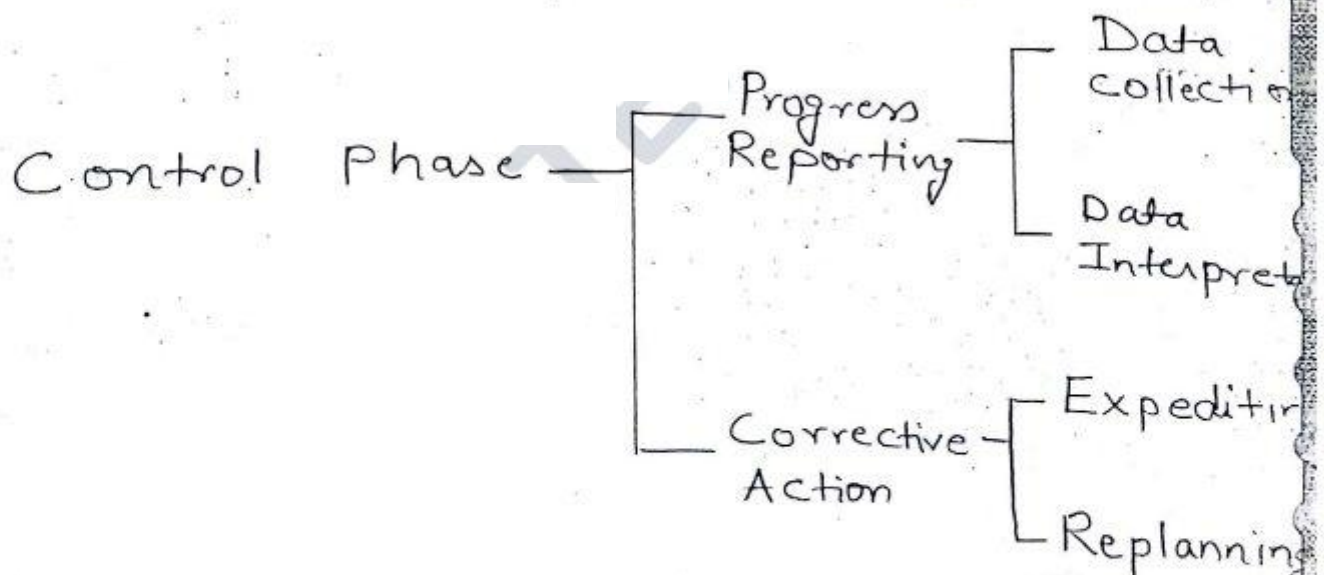
Production Planning :- It is a preproduction activity. It is the pre-determination of manufacturing requirements such as manpower, materials, machines and manufacturing process. It looks ahead, anticipates possible difficulties and decides in advance as to how the production best be carried out.

Production Control :- It comes into action, if there is a deviation between actual production and planned production. Production Control through control mechanism tries to take corrective action to match the planned and actual production. Thus production control reviews the progress of the work, and takes corrective steps in order to ensure that programmed production is

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Action phase ——— Dispatching



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Prior Planning:- It is a macro level planning and deals with analysis of data and is an outline of the planning policy based upon the forecasted demand, market analysis and product design and development.

1) Forecasting:- Looking & Predicting the future.

2) Order Writing (Preparation of Work authorisation)

It means giving ~~orders~~ documentation authority to one or more persons to do a particular Job.

3) Product Design (Preparation of work details)

In this step all the informations necessary to describe the work is collected in details.

Active Planning:- It is a microlevel detailed planning and starts after prior planning once the task to be accomplished is specified.

1) Process planning & Routing:- Process planning is the systematic determination of method or process by which the product is to be manufactured.

(16) economically & competitively within the design limits. Process planning is an intermediate stage between designing the product and manufacturing it.

Process planning is mainly concerned with:-

- Determining the manufacturing processes, sequence of operations, equipments, tools and labour required for the production of a component or a product.
- Co-ordinating the ~~effects~~ efforts of all factors in manufacturing the product.
- a guide to use the existing or the proposed facilities.

\* Route sheet contains information:
 

- ① Item to be manufactured
- ② Machine on which processing will take place
- ③ Details of operation.

Routing:- It is concerned with the selection of most advantageous path or route which the raw material should follow to get transformed into finished product. Route determines the arrangement of work stations. Routing is related to considerations of layout, temporary storage of in process inventory & material handling. A Route Sheet contains following info

2) Material Control:- Determination of material requirements and control of material (Inventory Control)

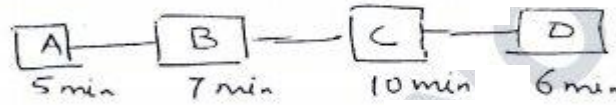
3) Tool Control:
 

- < Design & procurement of new tools
- < Storage & Maintenance of tools after Procurement.

4) Loading:- Loading may be defined as the assignment of work to the facility without specifying when the work is to be done. The facility may be equipment, manpower or both.

The ~~work~~<sup>or</sup> total amount of work has to (17) be converted into individual work load on each machine, this is known as loading.

Balancing:- To ensure that the individual work load on each of the machine are almost the same. In it we try to make "cycle time" almost equal to each of the station time.



In this production line, cycle time = 10 min.

Scheduling:- It gives answers to the question that when the work will be done and within what time it will be completed. Scheduling means when and in what sequence the work will be done. It determines which order will be taken up on which machine and in which department by which operator.

Scheduling is also called the time phase of Loading. Loading means the assignment of task or work to a facility whereas scheduling includes in addition, the specification of time & sequence in which the order/work will be taken up.

PERT, CPM, Bar chart, Gantt chart are all tools of Scheduling.

The common practise is that routing, loading & scheduling be performed simultaneously.

Action phase - work is started.

Dispatching:- This is concerned with starting of the production activities and it deals with the smooth introduction of work on to the line. It is in the process of setting

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Production activities in motion through release of orders and instructions. It gives authority to start the production activities by releasing materials, components, tools, fixtures and instruction sheets to operator.

Follow up or Control Phase: - once work is started it monitors the progress of work, it has two parts

1) Progress reporting:-

a) Data collection:- It involves collecting data for what is actually happening in the activity (Progress of work).

b) Data Interpretation:- After data collection this phase compares the actual performance against the plan.

2) Corrective Action:-

a) Expediting:- If the data collected from the production unit indicates that there is significant deviation from the plan and the plan cannot be changed, then some action must be taken to get back on plan.

b) Replanning:- If after expediting to correct deviation it is found that, it is impossible to perform according to plan, then it is necessary to replan the whole affair.