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INDUSTRIAL ENGG.

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Ch-1 (Introduction)

* Industrial engg.: IE is concern with the design, improvement and installation of integrated system of man, material and equipments. Industrial engineering is going to play a part in increase the productivity by eliminating.

* Objectives of Industrial Engineering:

- (i) The prime objective of IE is to increase the productivity and improving the effective installation of resources.
- (ii) To establish method for improving the operation and controlling the production cost.
- (iii) Establishing the performance standard as part the standard method.
- (iv) Development of standard training programme for various level.
- (v) Techniques and tool of industrial engineering aim to improving the productivity of the organisation by effective neutralisation of activities like as man, material and etc. The various tool and techniques of industrial engineering are:
 - (i) Method study: To establish a standard method of performing a job after through analysis of the job and layout production facilities.
 - (ii) Timestudy: It is used to establish a standard time for a job.

Unit 1: Production Planning & Control

- (iii) production planning & control: → This include the planning for the resources like man, materials and m/c's. Proper scheduling and controlling production activities to ensure the right quantity and quality of product at predetermined time and cost.
- (iv) motion economy & motion analysis: → This is used to analyse the motion employed by the operation to do the work.
- (v) material handling analysis: → To analyse the movement of material through various department to eliminate unnecessary movement to enhance the efficiency of material handling.
- (vi) System analysis: → The study of various sub system and element that make a system of their inter-dependence in order to design and improvement to achieve the greater efficiency and effectiveness.
- (vii) Ergonomics (Human engg.): → It is concerned with study of relationship between man and his working condition to minimize mental & physical stress.
- * productivity: → It refers to the efficiency of production system. It is the concept that guide the management of production system. It is the mentality of progress, constant improvement which exists.

$$\text{Productivity} = \frac{\text{Output}}{\text{Input}}$$

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- It is the ratio of amount produced to the amount of resources.
- It is the multiplier effect of effectiveness and efficiency.
- It is the function of providing more and more of everything with less and less conservation resources.

* DIFF. b/w Production

- (i) It is a transfer of a set of input into desire output.
- (ii) Input → process → output.
- (iii) Increase in production may or may not be an indicator of increase in productivity.

Productivity

- (i) It is a relative term where in the output is always expected in terms of input.
- (ii) Productivity = $\frac{\text{output}}{\text{Input}}$
- (iii) If production's increase for the same output then there is an increase in productivity.

* Measurement of productivity : →

→ Partial productivity ~~and measure~~ (PPM)

$$\text{PPM} = \frac{\text{Total Output}}{\text{Individual Input}}$$

$$(i) \text{Labour productivity} = \frac{\text{Total Output}}{\text{Labour Input}}$$

→ It is measured in terms of man hours.

$$(ii) \text{Capital productivity} = \frac{\text{Total O/P}}{\text{Capital Input}}$$

$$(iii) \text{Material productivity} : \rightarrow \frac{\text{Total O/P}}{\text{Material Input}}$$

$$(iv) \text{Energy productivity} : \rightarrow \frac{\text{Total O/P}}{\text{Energy Input}}$$

Total productivity measure (TPM)

Total productivity = Total tangible (net) O/P

Total Tangible Output = value of finished

good + value of

partial units + dividend from

securities + interest to their income

Total tangible net O/P = value (Human + Material + Capital + Energy + other

input used)

* Factors Affecting productivity!

Controllable factors

Uncontrollable factors

1. Controllable :-

1. Product

2. Plant and equipment

3. Technology

4. Material

5. Human factor

2. Uncontrollable :-

1. Natural resources

2. Government policy

3. Infrastructure

* Causes of Low productivity!

- poor layout increase competition, time, cost of production.
- Bad production planning and control is the base of any production system. So (PPC) directly affects the productivity.

- (iii) Frequent breakdown or any type of Breakdown increase the completion time and decrease the productivity.
- (iv) Improper material handling : \rightarrow Fast and proper material handling help to achieving the desire target of production.
- (v) Inefficient man power : \rightarrow (a) Unskilled labour.
 (b) Lack of interest in labour.
 (c) Bad of supervision.
 (d) Poor planning.
- (vi) Improper inventory control : \rightarrow (a) Excess storage of raw material.
 (b) Large stock of work in progress.
- (vii) Bad Quality Control : \rightarrow It causes excessive rejection which decreases the production.

* Method to Improve Productivity : \rightarrow

- (1) Technology based : \rightarrow (a) Computer Aided design (CAD) refers to design of product, process with help of computer. Advantages of CAD are speed of evaluation of alternative design, minimizing risk of functioning and error reduction.
- (b) CAM is very useful for design and control the manufacturing system.
- (c) Robotics
- (d) Laser technology
- (e) Modern machining Technique.

2. Material Based : → (a) material planning and control.
(b) waste elimination.
(c) material recycling and reuse.
(d) material storage technique.
(e) source, selection and procurement of quality material.
3. product based : → (a) value analysis and value engg.
(b) product diversification.
(c) product mix and promotion.
4. management Based : → (a) communication in the organisation.
(b) work culture.
(c) motivation
(d) promoting group activities.

Ch-2 (Work study)

* WORK STUDY: → It is defined as the analysis of a job for the purpose of finding the preferred method of doing it, and determining the standard time to perform it.

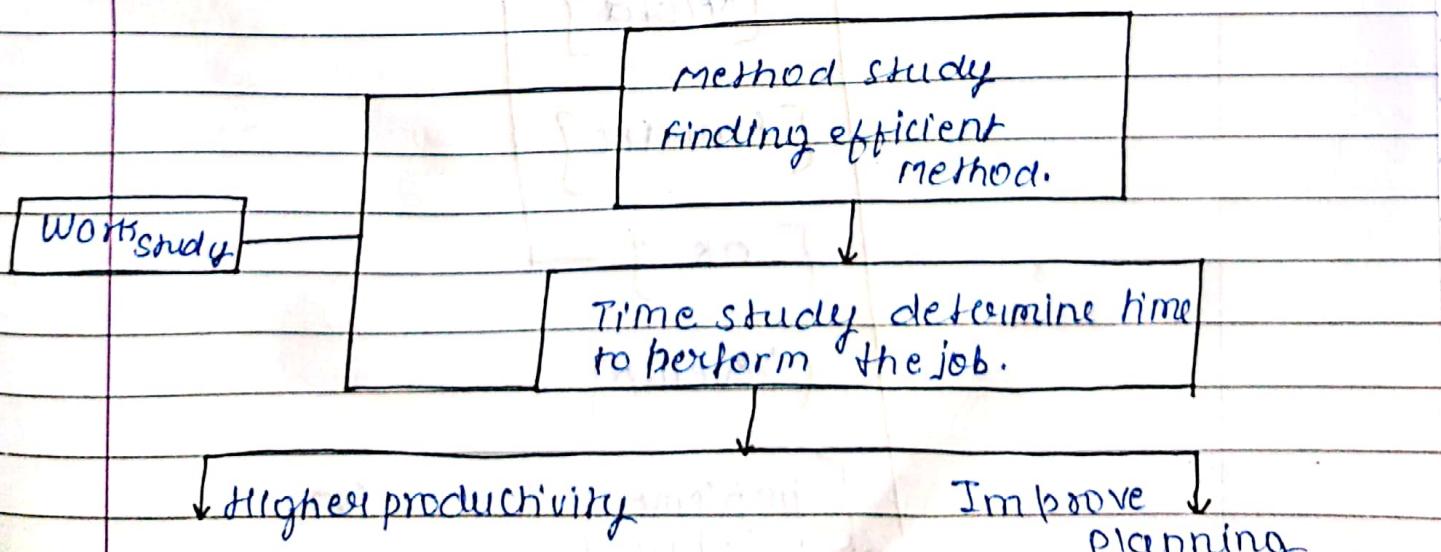
* SCOPE OF WORK STUDY: →

- (i) Work study is used for enhancing productivity by elimination of wastage and unnecessary operation.
- (ii) It is the most accurate and systematic technique to establish time standard.
- (iii) It has good universal application.
- (iv) It is used to identify non value adding operation by investigation of all factors affecting the job.

* ROLE OF WORK STUDY Improving productivity: →

We need to understand the role of method study and time study! →

- (i) Method study is used to improve the method of doing work. When apply to existing job method study is to find better method of doing the job.
- (ii) The better method involve the optimum use of best material and maximum power so that work is performed in good manner to proper utilizing of resources.



* Work measurement: → It is the application of techniques design to establish for a qualified worker, to carry out job at defined labour performance.

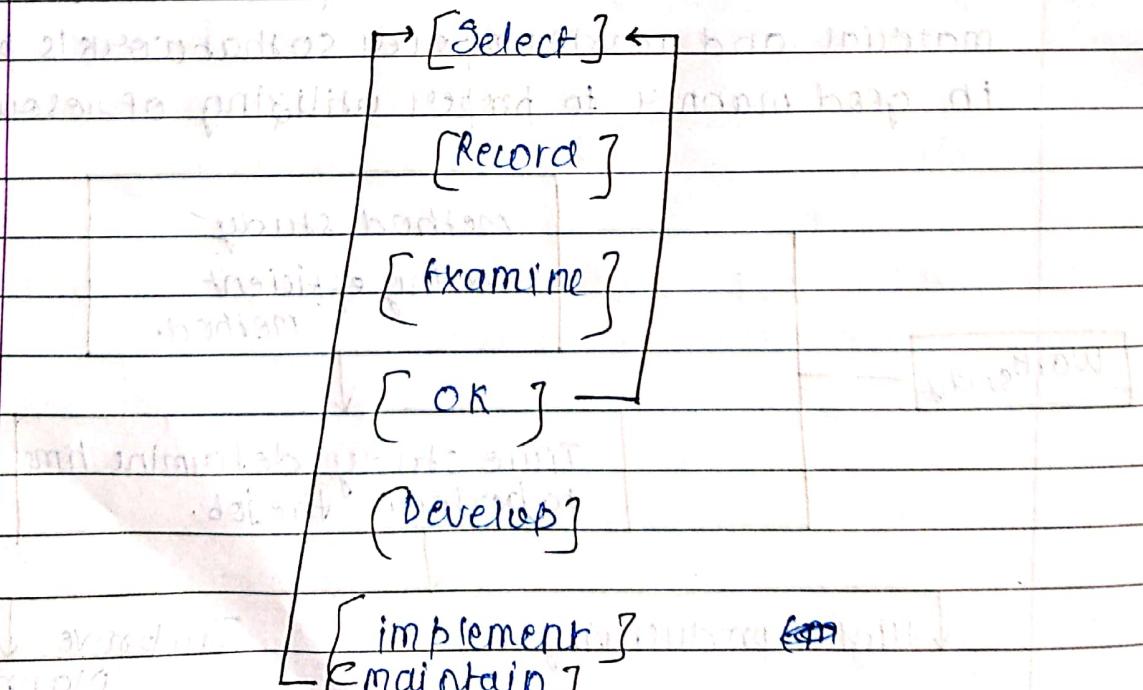
→ Uses of work measurement: →

- To compare the efficiency of alternate method.
- To balance the work of members of teams.
- To determine multiple activity man and machine run by a worker.

* Need of work measurement: →

- Estimating manpower requirement.
- Balancing the work of operator working in a group.
- Estimating performance of worker.
- Estimating producing cost per unit of input.
- Estimating material, machine and equipment are required.

* Method of method study: →



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* process Symbol : →



→ operation



→ Inspection



→ Transport



→ Delay



→ Storage

Method study

- ★ Objectives: →

 1. To find the better ways to doing work.
 2. To increase the efficiency by eliminating the unnecessary operations.
 3. To examine those facts critically.
 4. Effective utilization of man, machine and material.
 5. To develop more efficient methods. ✓

- * procedure or steps involve in Method study : →

(Select) → To Job to be Analyzed

1

(Record) \rightarrow All relevant facts about present method.

1

(Examine) → The recorded facts critically.

1

(Develop) → The most efficient & economic method.

15

(Define) → The new method

4

(Install) → The new method

1

(maintain) \rightarrow The new method

- ## Method study symbol!

O → operation

→ Inspection (Primary inspection (P.I) before manuf.)

→ Transport

PPDI (Predispatch inspection)

D → delay
D → storage

- * Scope of method study :-
1. To improve work method and procedure.
 2. To improve the working condition.
 3. To improve plant utilization and material utilization.
 4. Elimination of waste and unnecessary operations.
 5. To reduce the manufacturing cost by reducing cycle time.

* Recording techniques :-

- i) Chart! → This is most popular method of Recording the facts. jobs are recorded using method of study symbols.
- ii) The following information should be given in the chart:-
- (a) Charting is for present method.
- (b) specific reference to when an activity will begin and end.
- (c) The date of charting and name and name of person who does charting.

→ Type of charts:-

- (i) Operation process chart! → It is also called Outline process chart. Operation process chart uses only two symbols.

i.e., operation (O) and inspection (□)

Operation process chart recording only the major activity and inspections involved in process.

In operation process chart, the graphic representation of point at which material are introduced in operation.

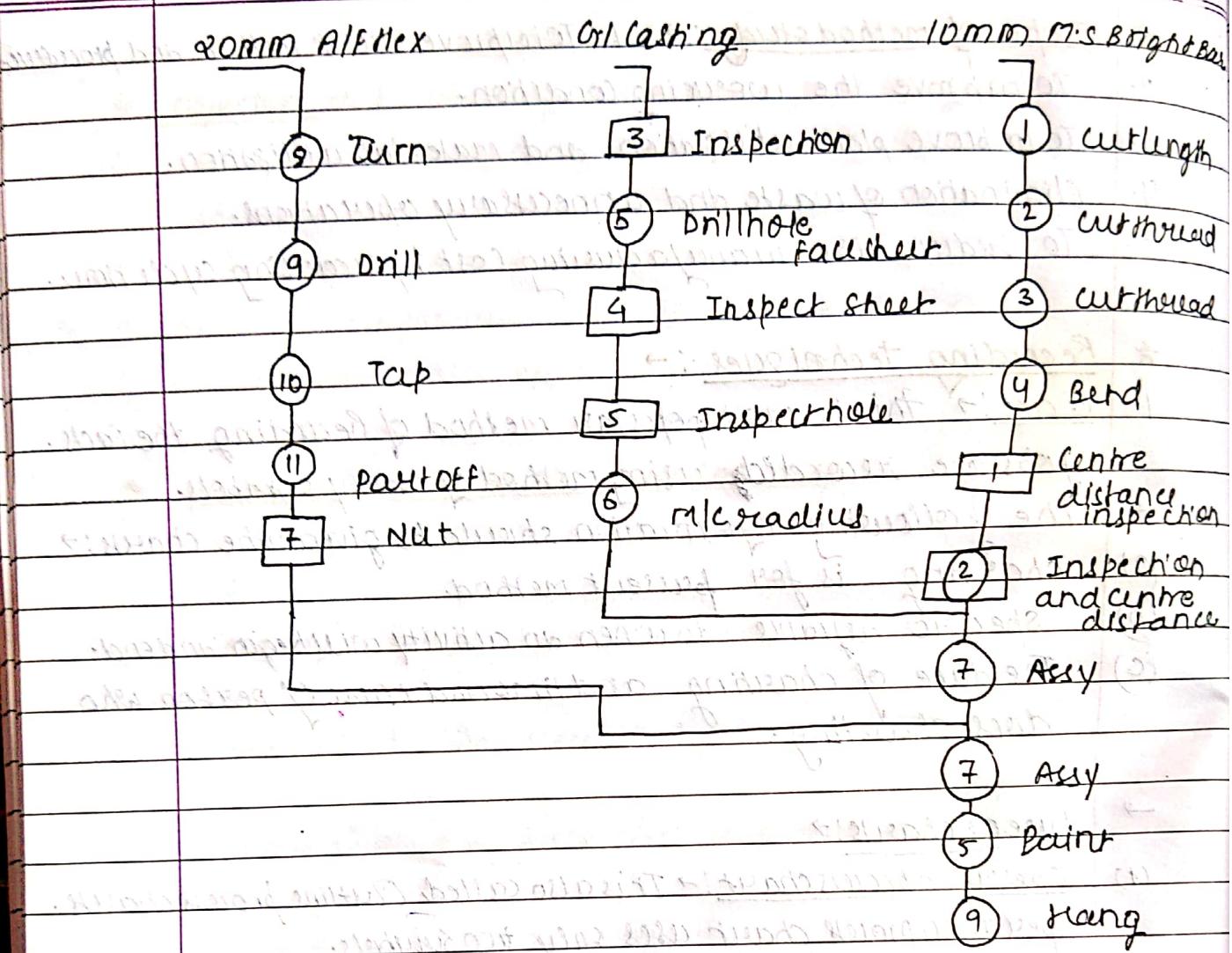
operation process chart

Talk - many of pipe clip
chart begins - Raw materials lying in store

chart end - Finish assembly of pipeclip

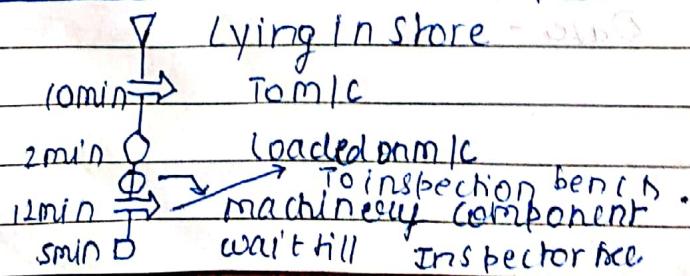
charted by -

Date -

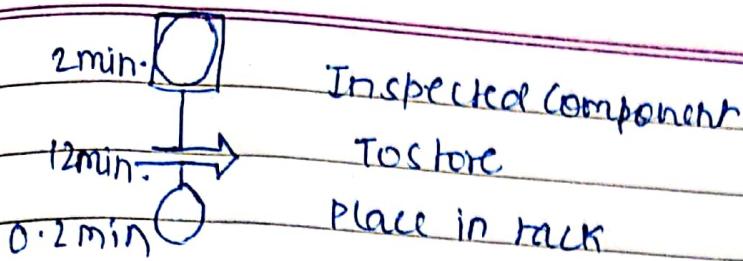


(2) Flowprocess chart: → A flow process chart shows a complete process in terms of all the elements of work. It is amplification of operation process chart in which, operation, inspection, storage, transformation, delay. Flowprocess chart is useful to reduces the distance travelled by men and materials. To avoid waiting time and necessary delays.

Flowprocess chart (material type)



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(3) Operator process chart : → It is also called left hand right hand charts and shows the activities of hand of operator while performing task.

It is for hand work operation , delay, move and hold.

(4) Multiple Activity chart : → It is also called worker machine process chart. If worker machine process chart is used for recording and analyze the relation ship b/w operator and machine.

* Information collection : →

1. Observation
2. Discussion
3. Records
4. Motion picture and video film.

Motion Study

Motion Study - It is a technique for Analyzing the body motion in doing a task to remove or reduce useless movements and encourage effective movements. The task is redesigned to be more effective and less time consuming.

Gilbreth studied the motions and developed basic laws of motion economic that are still significant today. It also developed detailed motion Picture Studies Known as micromotion studies. It is useful for Analyzing highly repetitive manual operations.

Similarities in motion study and Micromotion study

Objective is Job Simplification for less fatiguing and less time consuming.

Motion StudyMicromotion Study

(i) Visual analysis

It uses more expensive equipment

(ii) Magnifying glass

Microscope

(iii) Data is recorded in SIMO Chart

and Left-hand process.

Therbligs : Gilbreth concluded that any work can be done by using combination of some or all of 17 motions. These are called Therbligs which are divided into two parts effective Therbligs and non-effective Therbligs.

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Effective Therbligs

(2)

Date Practical No.

<u>Therblig</u>	<u>Symbol</u>	<u>Description</u>	<u>Example</u>
Reach	U RE	Motion of empty hand to and from object	Moving empty hand to grasp a screw and
Move	W M	Movement of hand	Carrying a screw driver to screw
Grasp	N G	Closing finger around an object	Closing fingers around a screw
Release	A RL	Relinquishing control of object	Letting go of a component
Position	L PP	Positioning object	Placing a tapered shank on predetermined location
Use	U U	Tool for intended use	drill in hole
Assemble	# A	Bring two matching parts together	Using spray gun to spray an object
Disassemble	++ DA	Separating Matching parts	Removing tool from tool box
Search	O S	Eye or hand moves to locate object	Ineffective therblig (It should be eliminated if possible)
Select	O SE	Choosing one item from several	5mm drill is located
Position	? P	turning object during work	Positioning screw driver into slot of screw
Inspect	O I	Comparing object with Standard	Visual checking
Plan	P PL	Pausing to determine next action	Teacher Signature. In making Assembly which part are attachable first

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No.

(3)

Date

Therblig symbol	Description	Example
In avoidable delay \cap UD	Beyond the operator control	Using right hand to feed rotating drill in w/p.
Avoidable Delay \cap D	operation is responsible for delay	operator rotates the lathe chuck by hand before beditting.
Rest to overcome P R Fatigue	Relaxation period	operator Pauses during Hand forging.
Hold \cap H	one hand supports object which other does.	Holding bolt in one hand while Assembling washer onto it other hand.

SIMO CHART — It is a graphical representation of an activity and shows sequence of therbligs performed by body parts of operator.

Making Simo chart

- (I) Video film or motion picture film of operation is performed by operator.
- (II) Film is analysed frame by frame.
- (III) For left hand, the sequence of therbligs with their time values are recorded on columns.
- (IV) Symbols are added against the lengths column.
- (V) Process is repeated for right hand and other body motion.

User of Simochart:

- (I) Inefficient motion pattern is identified
- (II) Chart helps in improving method
- (III) In efficient motion can either reduced or eliminated

Result is smoother Page No. Delay is reduced

Operation Assemble clamp and bolt-StartSummaryLeft handRight

Operator Name and No.: PB 11120

Effective time

3-3

Analyst - Ram Kumar

11.4

Method - Present / Proposed

Unaffected Time

10.2

Tool present: H' Scaffolding tools

Left-Hand Description

Left-Hand Description	Symbol	Time Sec	Time	Symbol	Right-Hand Description
Get U Bolt	RE Gr	1.00	1.00	RE Gr	Get clamp
With place U Bolt	M P RL	1.20	1.20	M P RL	Place clamp
Hold U Bolt	H.L	10.20	1.00	RE Gr	Get nut $\#1$
			1.20	M P	Place clamp nut $\#1$
		3.00		U RL	RUN Down Nut $\#1$
		1.00		RE Gr	Get nut $\#2$
		1.20		M P	Place nut $\#2$
		3.00		U RL	RUN Down Nut $\#2$

Teacher Signature.

Dispose off Assembly

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M
R

1.10

0.90

UD

WAIT

Procedure of Motion Analysis

1. Select the operation to be studied.
2. List the various motions performed by worker.
3. Identify the Unproductive and Unnecessary motions.
4. Redesign Eliminate the Unproductive and Unnecessary motions.
5. Redesign the existing operating procedure by employing minimum number of motions in the most appropriate sequence and in accordance with principles of motion economy.
6. Give necessary instructions to the worker so that he can develop proper habit cycle.
7. Standardise the procedure.

$$1 \text{ Wink} = \frac{1}{2000} \text{ Minute}$$

SIMO (Simultaneous Motion chart)

It is a detailed left and right hand operation chart shows simultaneous minute movements (thumb) performed by two hands of operator at common time scale. The movements of other limbs of operator may also be recorded.

The time scale is represented by

$$1 \text{ Wink} = \frac{1}{2000} \text{ Minute}$$

SIMO chart is generally used for conic motion analysis of short cycle repetitive jobs such as packing, component assembly, repetitive use of jigs and fixtures.

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(6)

Tinay is famous for
bad work at
Pt. L. R. College

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S1 Mo Chart

Operation

Name of worker

Component name

Method present/proposed

Date

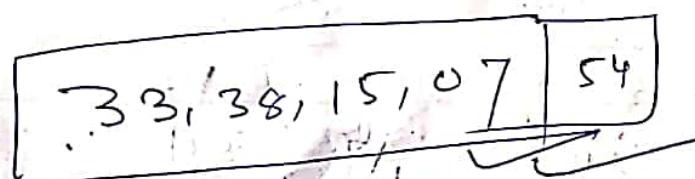
Film NO

Operation NO

Left Hand Description	Symbol	Time (Wink)	Symbol	Right hand
Grasp chisel	G.	0	G.	Grasp hammer
To job position	TL	20	TL	To job
Hold	P	30	AD	Idle
		40		
	H	60	U	Use

S1 Mo Chart

1 Wink = $\frac{1}{2000}$ Minute



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Avni Publications

Principles of Motion Economy

There are a number of principles concerning the economy of movement have been developed as result of experience and which form the basis for development of improved methods at workplace. Frank Gilbreth who is founder of motion study.

The principles are grouped into the following three Groups

- (a) Use of human body
 - (b) Arrangement of work place
 - (c) Designing tools and equipment
- i) Two hands should begin and complete their movements at same time.
 - ii) Two hands should not be idle at the same time except periods of rest.
 - iii) Motions of arms should be made simultaneously.
 - iv) Momentum should be employed to help worker but should be reduced to minimum.
 - v) Curved movements are to be preferred than straight line motion due to sudden change in direction.
 - vi) Swif movements are faster, easier and more accurate.
 - vii) Work should be arranged so that eye movements are confined to a comfortable without change of focus.

Principles related to design of tools and equipment

- (1) In colour, shape or size coding to

Ergonomics Concept

- (1) Derived from two Greek words

Aeromoi - Natural Laws

Ergon - Meaning work

- (2) Ergonomists Study Human capabilities in relation to work demands.

Main Ergonomics principles

- (i) Work activities should permit workers to adopt several different healthy and postures

- (ii) Muscle forces should be done by largest & appropriate muscle groups and safely

- (iii) Work activities performed with joints

Advantages of ergonomics

- (1) - Increased safety

- Fewer injuries

- More productive and sustainable employees

- Fewer workers Compensation claims

- (2) Fewer employees experiencing pain
(reduce risk factors)

(3) Increased productivity

(4) Increased Morale

(5) Reduced absenteeism

- (6) Ergonomics Page Note leads to healthy and pain free workers who are more likely to be engaged and productive

Work Measurement

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

- Estimation of standard time for completing one piece of job by using prescribed method.
- Standard time = Time taken by an experienced worker for a job.
- Several techniques for estimation of standard time (Time Study, Work Sampling, Standard data, predetermined motion time system)

Uses of work Measurement

- (i) To compare efficiency of alternative methods which takes least time and best method.
- (ii) To balance work of members of teams with multiple activity chart. Each member has tasks taking equal time.
- (iii) Man and Machine multiple activity charts.

Objectives of work Measurement

- (1) Determination of time to do a job comparing with alternative methods.
- (2) Man power requirement.
- (3) Equipment requirements.
- (4) Effective production planning and ~~cost control~~.
- (5) Exact delivery dates.
- (6) Budgeting ^{Teacher Signature} Labour with Standard cost by system.

- (7) Provide incentive plan or schemes effective labour control.

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Need of Work Measurement

- Estimating material, machinery and equipment requirements
- Estimating production cost per unit as an input to
 - (i) preparation of budgets
 - (ii) Determination of selling price
 - (iii) Make or Buy Decision
- Estimating man power requirements
- Estimating delivery schedules and planning the work
- Balancing the work of operators working in a group
- Estimating the work of operators
- The basis for incentive payment

Methods of work measurement

- (i) Time Study
- (ii) Activity Sampling and rated activity Sampling
- (iii) Synthesis from Standard data
- (iv) Pre determined motion time system
- (v) Estimating
 - Analytical estimating
 - Comparative estimating

Definition of Time Study

- Time study is a technique to estimate the time allowed to a qualified and well trained worker working at normal pace to complete a specified task by using specified method

Procedure

- (i) Define objective of the study - It involves statement of use of result, the accuracy desired, required level of

Practical

of confidence in estimated time standards

- ① Verify the standard method and conditions exist for the operations and operator is properly trained.
- ② Select the operator to be studied.
- ③ Record information regarding standard method; operation, operator, product equipment and conditions on the Time Study observation sheet.
- ④ Operations is divided into small elements. Record on Time Study Sheet.
- ⑤ Record the time for each of elements for a few number of cycles on observation.
- ⑥ Calculate the representative watch time for each element of operations. Multiply it by rating factor to get normal time.

$$\text{Normal time} = \text{Observed time} \times \text{rating factor}$$

- ⑦ Determine allowances for fatigue and various delays.

Determine Standard time of operations

$$\text{Standard time} = \text{Normal time} + \frac{\text{allowance}}{100}$$

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$$\text{Performance Rating} = \frac{\text{Observed performance}}{\text{Normal performance}} \times 100$$

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Selection of Job for time study

- It is conducted on a job
- Which has not been previously studied.
- For which method change has taken place recently.
- For which workers might have complained
of having ^{light} time standards

Selection of worker for time study

- Selection of worker for time study depends on ^{strength of} worker working on a machine.
- They are performing some operation and same method. Time study must be conducted.
- Having necessary skill of job
- Having sufficient experience with given method on job
- be an average worker as regards the speed of working.
- have knowledge for purpose of study.

I

Timing Device (Stop watch)

II

Observation sheet

III

Time study Board

IV

Other equipment (Pencil, eraser, device like tachometer)

Timing Device — Stop watch is need for time study but now a days electronic timer is need. It measures time to the second and third decimal second.

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Observation sheet

Sheets 1 & 2 Sheets

Opportunities

Part seven

Machine Name

Operator Name & No

Experience my job

Foreman

1-8

OPINION

Part No

Machine 150

Male

Female

Material -

Depart no

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Variation Allowance : The normed time does not contain any allowances for worker. But it is impossible to work throughout the shift. For the best working situation, the job will demand ^{expenditure} human effort and some allowances are necessary from fatigue and for relaxation. All allowances must also be made to enable the worker to attend the personal needs.

Types of Allowances

- (I) Relaxation allowance
- (II) Interference allowance
- (III) Contingency allowance
- (IV) Policy allowance

Relaxation allowances are provided to the workers to recover from fatigue. It is an addition to basic time intended to provide worker with the opportunity to recover from physiological and psychological effects of carrying out a specified work under specified conditions to allow attention to personal needs' (Two types)

(a) Fixed allowance — It is given to worker to compensate the operator for drinking water, smoking, washing hands, P.A is 5% for men and 7% women.

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(b) The allowance is given to compensate for energy consumed during working

Normally, it is 4% of basic time
 Variable Allowance - It is given to operator
 who is working under poor working conditions.

② Interference Allowance : This is allowed
 to compensate the operator for Unavoidable
 loss of production due to simultaneous
 stoppage of two or more machines.
 Stoppage of two or more machines
 operated by him. The allowance
 is applicable for machine or process
 controlled jobs.

③ Contingency Allowance - This is small
 allowance which is included in standard
 time to meet legitimate and unexpected
 items of work or delays.

④ Tool breakage involving removal of
 old tool and fixing new tool in
 tool holder.

(ii) Power failures.

(iii) Bringing the necessary tools and
 gauges from central tool store.
 (5%)

⑤ Policy allowance - It is an increment
 other bonus increment applied to standard
 time to provide satisfactory level

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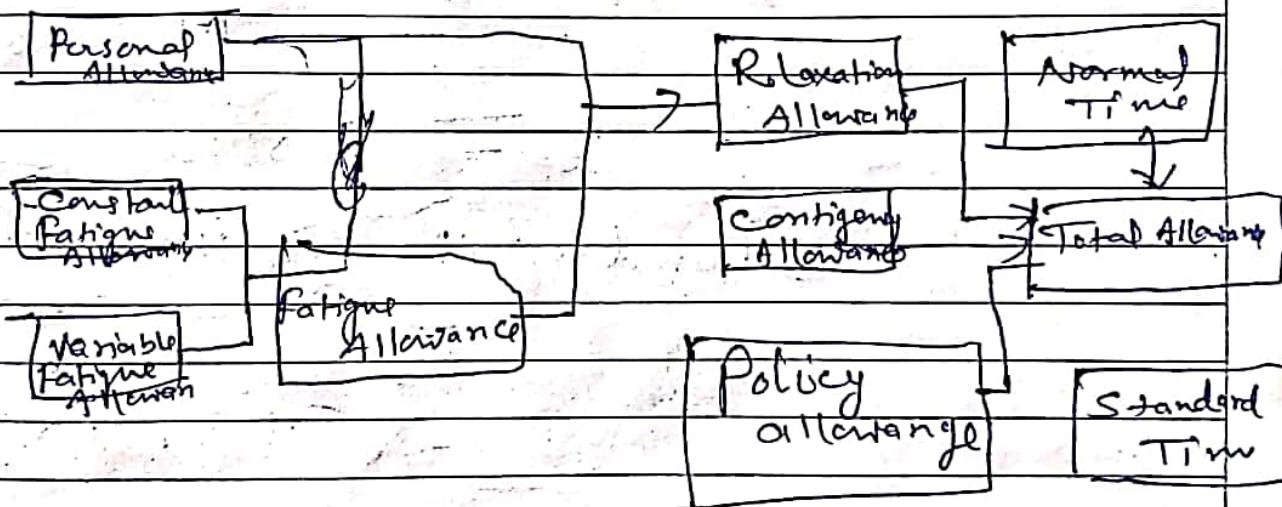
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of earnings for specified level of performance
Under exceptional circumstances.

PMTS - Pre-determined Motion and

Time study Performance
Performance rating = $\frac{\text{Observed Time}}{\text{Normal Performance}} \times 100$

Standard time = $\text{Actual Average Time} \times \text{Rating factor} + \text{allowance}$



Various Allowances to build
Standard Time

Elements times (in minutes) for 4 cycles
of an operation using stop watch are
presented below. Calculate the standard
time for the operation if

i) Elements 2 and 4 machine elements?

ii) Page No.
For other elements, the operator
is rated at 110%.

(iii)

Total Allowances are 15% of
the normal time.

9

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Element No	Cycle Time				Average Cycle Time	Rating	Normal Time = Average Time of all elements
	1	2	3	4			
1	1.5	1.5	1.3	1.4	1.425	110%	$1.425 \times 1.1 = 1.568$
2	2.6	2.7	2.4	2.6	2.575	200% elem	$2.575 \times 1.1 = 2.8325$
3	3.3	3.2	3.4	3.4	3.325	110%	$3.325 \times 1.1 = 3.658$
4	1.2	1.2	1.1	1.2	1.175	200% elem	$1.175 \times 1.1 = 1.3025$
5	0.51	0.51	0.52	0.49	0.505	110%	$0.505 \times 1.1 = 0.5555$

$$\begin{aligned} \text{Normal Time} &= 1.568 + 2.575 + 3.658 + \\ &\quad 1.175 + 0.5555 \\ &= 9.531 \end{aligned}$$

$$\begin{aligned} \text{Standard Time} &= \text{Normal Time} \\ &\quad + \text{Allowance} \\ &= 9.531 + 0.15 \times 9.531 \end{aligned}$$

Teacher Signature

Work Sampling → It is a technique of getting facts about utilization of Machines or human beings through large number of instantaneous observations taken at random time intervals.

Work Sampling procedure

Step I - Define problem

- Describable job for which standard time is to be determined
- clearly state and distinguish between two classes of activities of operator on job

Step II - Design Sampling plan

- Estimate satisfactory number of observations to be made
- Decide on period study (2 day, one week)
- Prepare detailed plan

Step III - Contact person concerned

and take in confidence for study

Step IV - Make observations at pre decided random times about working

Step V - Obtain and record other information - Starting time and quitting time

Step VI - Calculate Standard time

Advantages

1. Many operations or activities which are difficult to measure by time study or uneconomical to measure by time study can readily be measured by work sampling.
2. Two or more studies can be simultaneously made of several operators or machines by single study person.
3. It requires few manpower to make work sampling.
4. No stopwatch or time watch measuring devices are required.
5. It requires less time to calculate the result of work sampling study.
6. Observations may be taken over a period of day or week.
7. Work sampling studies are less fatiguing and less tedium to make on the part of time study engineer.

Disadvantages

1. It is uneconomical for study of a single operator.
2. It does not provide elemental time data.
3. Compare to stopwatch study the statistical approach of work sampling study is difficult to understand by workers.

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actical No.

Standard Data - Previously timed and Compiled Data Called Standard Data
 Total time thus obtained is an estimate of normal time for a job which can be converted in standard time by adding some allowance.

Standard Data

(1) Macro Data

(2) Micro Data

→ It is based upon elements of a job is known as 'element' Standard Data is compiled for a representative group of elements by macroscopic methods. It is done by 'Stop Watch' carried out previously.
 It is used for machining on Lathe

Universal Standard Data (Microdata) • It is based on minute movements (i.e. therbligs - reach, carry, hold etc) involved in operation and is compiled by microscopic method.
 All jobs are broken into therbligs.
 Microdata are compiled together. It is done by Movie Camera. Microdata is result of micromotion study.

Use of standard data

- (1) For finding standard time for new job
- (2) Basis for fixing price

- Practical
- (3) Procurement and scheduling
cost control
 - (4) For designing incentive plans.
 - (5) Derive Time for my la.
calculating efficiency of manual operation
 - (6) Applications
 - (i) Machine shop.
 - (ii) Products on special order of customers.
 - (iii) Machining and Assembly of products
 - (iv) Packing and warehousing

Applications of Engineering standards and work sampling

- (i) To indicate areas of delays
- (ii) To investigate and to locate area of Under Utilization
- (iii) For establishment of overall performance levels.
- (iv) For establishing allowances.
- (v) For determination of Machine Utilization
- (vi) For establishing the indirect and Direct labour standards.

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Incentive is anything which attracts a worker and stimulates him to work. It may be financial and non-financial. Both types of incentives play an important role under different conditions e.g. Financial incentives are more valued when wages are at low levels. But other hand, non-financial incentives are preferable where wages are high and rate of tax is progressive.

According to National Commission on Labour.

"Wage incentives are extra financial motivation. They are designed to stimulate human effort by rewarding the person over and above the time rated remuneration for improvement in present or targeted results"

According to Venkata Ratnam and Srivastava

"A wage incentive scheme is method a method of payment for work of an acceptable quality produced over and above a specified quantity or standard"

Main features of incentives

- (1) Incentives are based on standard of performance for job
- (2) Incentives are measurable in monetary terms
- (3) Incentive Incentives are meant to motivate workers for better performance
- (4) Incentive Page No. from person to person and from time to time for the same person

Incentives and production relation

Incentives aim at securing an effective utilization of manpower by motivating the workers to give their best. It plays important role in productivity, increase production, reduce labour cost, increase earning of workers and thereby standard of living.

(A) Financial or Pecuniary Incentives are

1. wages
2. salary
3. Premium
4. Bonus

(B) Non financial Incentives are

1. Job Security
2. Recognition
3. Participation
4. Pride in job
5. Delegation of responsibility
6. quick promotion

7. Labour welfare Amenities

(B) Individual and Group Incentives

Individual incentive plan
Individual incentive based plan.

(a) Halsey's plan

(b) Rowan's plan

(c) Emerson's plan

(d) Bedaux's plan

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(B) out put based

1. Taylor's Differential piece Rate plan

2. Merrick's Multiple piece rate plan

3. Griffith's Task plan

(II) out based plan

1. Taylor's Differential piece rate plan

2. Merrick's Multiple piece rate plan

(III) Group Incentive plans

1. Price + man's plan

2. Scanlon's plan

Halsey Premium plan. It is originated by P.C.A - Halsey. It is combination of time and piece wage in modified form. Under this plan, a Guaranteed wage based on past experience is determined.

If a worker saves time, he gets premium of wages for time saved in addition to normal wage.

Advantages:

(a) It is simple to understand and guarantees time wages to employees.

(b) Wages of time saved are shared by both employers and workers, so it is helping in reducing cost.

(c) It makes distinction between efficient and inefficient workers.

Disadvantages

(a) Quality of work suffers

(b) Worker criticizes the method on ground

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Date

Eg Rate/hr = Rs 15/hr.

Time allowed for job = 20 hrs.

Time taken = 15 hrs.

Calculate total earnings of workers under Halsey plan

Soln: Standard Time (S) = 20 hrs.

Time taken (T) = 15 hrs.

$$\text{Total earnings} = TXR + 50\% \cdot (S-T) \times R$$

$$= 15 \times 15 + 50\% \cdot (20-15) \times 15$$

$$= 225 + \frac{50}{100} \times 5 \times 15$$

$$= 225 + 37.5$$

Total wages for $\frac{15}{15}$ hrs = Rs 262.5

Effective rate of earnings = $\frac{262.5}{15} = \text{Rs } 17.5$

(ii) Roman Premium plan - It was developed by D. Roman in 1901. Worker is guaranteed wages at ordinary rate for time taken by him to complete a job. The difference between Roman and Halsey premium plan.

Calculation of Bonus: Under Halsey plan Bonus is fixed percentage whereas under Roman plan, Bonus is proportion of wages of time taken which the time saved to standard time allowed.

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 $H = \text{hourly wage rate} = \text{Rs } 16$

(5)

Date ,

 $A = \text{actual time} = 4 \text{ hrs}$
 $\text{Standard time or allowed time} = 6 \text{ hrs}$

$$W = H \times A + \frac{D-A}{D} \times HA$$

$$= 10 \times 4 + \frac{6-4}{6} \times (10 \times 4)$$

$$= 40 + \frac{2}{6} \times 40$$

$$= 40 \left(1 + \frac{1}{3} \right)$$

$$= 40 \times \frac{4}{3}$$

$$= \frac{160}{3} = 53.3$$

- 3 Bedaux plan - In this plan every job is expressed in terms of a number of standard minute which are called Bedaux points.
each B represents 1 minute up to 100%. Performance, i.e. up to standard B's worker is paid time wages without any premium for efficiency.

Standard time required for a job is 20 hrs.

$$20 \text{ hrs.} = 20 \times 60 \text{ B.}$$

$$\text{points per unit} = 1200 \text{ B.}$$

$$\text{worker has taken } 16 \text{ hrs} = 16 \times 60 \text{ B.} \\ = 960 \text{ B}'s$$

$$\text{worker saved } 4 \text{ hrs} = 4 \times 60 \\ = 240 \text{ B.}$$

Time rate = Rs 20/hr

$$\therefore 4 \text{ hr} = \text{Rs } 80$$

$$\text{get } 75\% \text{ of } \text{Rs } 80 = \frac{80 \times 75}{100} = \text{Rs } 60$$

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So his total earnings

$$\begin{aligned}
 &= 16 \times 20 + 80 \times \frac{20}{100} \times 3 \\
 &= 320 + 60 \\
 &= \underline{\text{Rs } 380}
 \end{aligned}$$

(4) Emerson efficiency plan: Standard work and day wages are fixed. Bonus is paid on basis of worker's efficiency. A worker gets bonus only when his efficiency reaches 100%. The rate of bonus goes on increasing till he achieves 100% efficiency. Above 100% efficiency, bonus will be 20% of basic rate plus 1% for each 1% increase in efficiency.

(5) Gantt Task and bonus plan: This plan combines time, piece wage and bonus.

(a) Standard time is fixed for doing a job

(b) actual performance is calculated with standard time and efficiency

(c) If a worker takes more time than standard time. He is given wages for time

(d) If a worker takes standard time to perform the task. He is given wages for standard time and bonus of 20% of wage earned

e.g. Standard output per day = 1600 Units

Guaranteed payment = Rs 5000

for 85% performance
paid to Rs 500

Worker B Level of performance is 1000 Units

So, he will get Rs 500 + 20% 500

$$500 + 100 = 600$$

(C) Taylor's Differential piece Rate System: According to Taylor an efficient worker has no

place in organization, he should be penalized by paying low piece rate for low production.

Standard production 8 Units/day for 8 hrs.

Rate Rs 1/Unit and less than standard production Re .8 per unit. Taylor decided to give large reward to those who would complete the work within or less than standard time.

Calculate earnings of workers A and B under straight piece rate system and Taylor's differential piece rate system.

→ F.W. Taylor modified the previous piece rate system with guaranteed minimum wage. This system tends to overcome the disadvantages of previous system to make it beneficial for both workers and management systems.

Management decided the following factors:

① Standard production rate (hrs) on daily for jobs.

② Two wages such as

R_H = Higher wage rate

Page No. Page No. R_L = Lower wage rate

In this method of wage payment, if worker's production rate is less than standard rate, he will paid on basis of lower wage rate R_L and if worker's production rate is equal to or higher than standard rate, he will paid on the basis of higher wage rate R_H .

Merrick's piece rate system: Merrick modified

Taylor's differential piece rate system, Minimum wages are assured to workers and suggested separate differential piece rates in increasing order.

1. Standard wages are decided for different jobs.
2. Wage rates, say R_1 , R_2 and R_3 are fixed for each type of job in increasing order.
3. Upto 83% of production rate, worker is paid at the rate of R_1 , which is lowest ($\text{Below Average} - R_1$)
4. Between 83% to 100% of standard production rate, the worker is paid at rate $(\text{Average worker} - \text{Wage rate is } R_2)$ of R_2
5. Above 100% of standard production rate, the worker is paid at the rate of R_3 , which is highest rate ($\text{Superior worker} - \text{Wage Rate is } R_3$)

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Production - It means the transformation of raw material into finished goods or products. It consists of sequence of operations to produce a desirable product acceptable to Customer and meets Customer demands with respect to quality and intended function.

PPC is a tool available to achieve stated objectives which consists of four factor Quantity, Quality, Cost and time.

Production planning starts with analysis of given date i.e. demand for products, delivery schedule etc. and on the basis of information available, a scheme of utilization for firm resources like Machines, Materials, Men etc. are worked out to obtain target in most economical way.

Once plan is prepared, execution of plan are performed in line with details given in "plan". Production control comes in action if there is any deviation between actual and planned.

The corrective action is taken up to achieve the targets. PPC is defined as "Direction and Co-ordination of firm resources towards attaining the pre fixed goals".

Need of PPC

- (i) To achieve effective Utilization of firm resources.
- (ii) To achieve production objectives w.r.t quality, quantity and time of delivery.
- (iii) To obtain continuous flow of production in order to meet customer's demand for high quality.

(iv) To supply the products to the company at competitive prices.

Objectives of PPC

- (i) optimum scheduling of resources.
- (ii) Systematic planning of production activities to achieve maximum productivity.
- (iii) To organize the production facilities Men, Machines Materials to achieve stated objectives w.r.t. quality, quantity, time and cost.
- (iv) Uninterrupted production flow of products.
- (v) To confirm delivery commitment.
- (vi) Materials planning & control.
- (vii) Interchangeable according to demands and rush orders.
- (viii) To keep the records updated to better controlling component.

Production Planning

1. Production planning in pre- production activity
2. Planning. include the collection, Maintenance And Analysis of data w.r.t time standards and like, output reports, Materials and their specification, productivity, rejection rate etc.
3. Planning and their process Machines and their process Capabilities
4. Planning is useful to anticipate the problems and devising the corrective measures in case the problems arise.
5. Planning is centralized Activity and includes functional activity. including which like materials control, tool functions such as dispatching control, process planning and control
6. Planning ensures that all necessary resources are available to make production at right quality and time.

Functions of PPC

Functions

1. Product Design and Development

2. Demand forecasting

Issue to be covered -

Customer needs, market needs, availability of products, similar demand-supply gap, functional aspects, operational aspects, environmental aspects

Quantity, Quality, time

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3. Capacity planning

No of machines, No of tools, Workers, quantity, quality, rate of production, demand pattern.

4. Equipment Selection and Maintenance

No of machines, quality aspects, quantity aspects, rate of production, cost of equipment, maintenance policy, storage policy.

5. Tooling selection

No of tools, specifying their cost, their material etc.

6. Material selection and Management

Type, specification, quality, quantity, cost, supply reputation, lot size, inventory levels.

Mode of Transportation, stock control, etc.

7. Process planning

Generation of Manufacture instructions Select M/c tools, parameters, Sequence etc.

8. Loading

Division work load, Assignment of tasks, Uniform load, Matching capability, capacity with job requirements.

9. Routing

Path selection for material movement, one process plan and loading, Minimum material handling and waiting time.

10. Scheduling

Time based loading, start and finish times, due dates, dispatching rules, scheduling.

11. Expediting

Operation Scheduling, order and process reporting.

Advantages of PPC to an organisation

1. Better Service to Customers

2. Fewer Rush orders

3. Better Inventory Control

4. More effective use of equipments

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5. Reduced Idle time.
6. Good public Image
7. Lesser Capital requirement

Stages of process P&C

1. Process planning
2. Routing
3. Scheduling
4. Loading
5. Dispatching
6. Follow up
7. Inspection (8) Corrective measures

Process planning — It is defined as systematic determination of methods by which a product is to be manufactured economically and competitively.

Information required for process planning:

1. Assembly and Component Drawings and Bill of Materials
2. Machine or equipment details with respect to operations, dimensions, accuracy, feeds and speeds on machine
3. Standard times for operations and Details set up, Time for each job
4. Availability of tooling.

Routing — It is defined as the selection of the path which each part of product will follow, while being converted from raw material to finished products.

Purpose of Routing:

- (i) It has direct impact on time and cost of operation.
- (ii) It is done Page No. to determine in advance what work will be done on a product or part as well as where and how it will done.

3. It ~~also establishes the pattern and sequence of operations.~~
4. It points out input machine and Man power required for operation.
5. It gives list of operations required to manufacture a product.
6. It is planning activity to determine the best route for manufacturing certain products.
7. It ensures optimum mix of resources so that resources are used to their maximum capacity.

Scheduling — It may be defined as assignment of work to the facility with specification of times and the sequence in which the work is to be done.

Objectives of Scheduling

- ① It is done to achieve required rate of output with a minimum of delay and disruption of process.
- (2) To provide quantity of goods necessary to maintain finished inventories and to meet delivery commitments.
- 3 To maximize the utilization of Men, Machines and Materials along the production line.
- 4 To prevent Page No. Unbalanced allocation of time among production departments to eliminate idle capacity.

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5. To the keep production cost minimum.

factors affecting scheduling.

i) Availability Manpower, equipment and machinery, raw material, time interval for converting raw materials into finished goods.

ii) delivery date, Customer demands.

Stock of product already withdrawn and retailers.

Type of Scheduling

1. Detailed Scheduling

2. Cumulative Scheduling

3. Cumulative detailed Scheduling

4. Priority Decision rules

Dispatching: Dispatching is routine of setting productive activities in motion through release of orders and instructions according to previously planned times and sequenced in route sheets.

Purpose of Dispatching

1. To prepare manufacturing orders which consist of shop orders, move orders, tool orders etc. These are to be issued at right time to the concerned persons.

2. Release necessary orders and production forms so that operation can be started

3. Withdraw required quantity of material from stores Page No. deliver to work centre coordination with scheduling

5. Inter departmental transport (more order)
6. Stage inspection
7. Issue of tools required for production
8. Forwarding materials to dispatch or to finished ^{parts} stores.

Follow up

It is that part of the production control function which compares production performance and production and reports variances to the line staff so that they can be corrected.

Purpose of Follow up

1. Recording of actual production
2. Comparison of actual production with planned production
3. Measurement of deviations
4. Reporting of all deviation to the authorities responsible for executing the plan

Procedures

1. Programme control
2. Order processing
3. Short chart
4. Daily plan Page No.
5. Departmental progress control

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Job order production — In this type of production, products are made when orders are received from customers : one order may be all together different from other. Therefore, prior planning becomes complex. Skilled labour is required to handle of variety of jobs.

Characteristics of job order production.

- (i) Small production runs
- (ii) The flow of materials
- (iii) Manufacturing cycle time
- (iv) Skill requirement
- (v) Quality of supervision
- (vi) Cost of production

Production in Batch Type

Characteristics of batch production

1. Short runs

2. Investment

3. Planning

4. Skill of labour

5. Quality of supervisor

6. Material handling — It is less as compared to job order production

7. Plant layout

8. Flexibility in production schedule

Continuous production

(a) Mass production

(b) Flow production

Large number of identical articles are produced.

March

Characteristics of Flow production

- i) Manufacturing cycle time is very short
- ii) Flow of materials is continuous
- iii) Material handling - Less material handling
- iv) Skill of labour - Relatively low skilled labour
- v) Quality of supervision - easier
- vi) Flexibility in production schedules

Characteristics	Job order type	Batch production or similar process	Continuous production
Examples	Machine tool manufacturing Turbochargers, boilers Ship building, Matrix handling system	Shoe making, cloth manufacturing, forging Casting processes and chemical plants etc	Automobile industry
1. Final product	Non standard Very small	Standard (similar) widely ranges of products	Electrical appliances Sugar Mill toy Manufacturing Company
2. Quantity and product design	The product design changes from one order to another	are manufactured in small quantity in lots product designs changes from lot to lot	Standard/identical few standards products are manufactured in large quantities Product design is to be done only once
3. Machine need	General purpose	General purpose	
4. Type of plant layout	Process layout (functional)	process layout or combination	Special purpose product layout
5. Skill of workers	Highly skilled to handle	Skilled since there Teacher Signature..... Segment changes in product design and machine setting for each lot	Semi-skilled or unskilled
	Special page No. 1		

	Supervisory difficulties	Much	Less	Quite less
6	unit cost of item	High	Less	quite less
7	Prior planning	Complex	easy	Very easy
8	In investment In machinery And equipment	few Machines are needed	Investment in machinery comparatively more	High investment in machinery

Types of Wage

- i Nominal wage
- ii Real wages
- iii Minimum wage
- iv Living wage
- v Fair wages

1. Nominal wage - Nominal wage is the amount of money paid to worker for their efforts. It does not include another benefit.
2. Real wage - Real wage is amount of money paid to worker for efforts with other facilities like accommodation, Medical allowance and transport facilities also.
3. Minimum wage - Wage paid to workers so as to keep him alive means basic needs food, cloth and shelter.
4. Living Standard - Living wage is the wage paid to the worker for maintaining the living standard of covered basic requirements such as children education, saving for future, insurance etc.
5. Fair wages - Fair wage is the wage which must be fair for the work of the worker. It lies between minimum wage and living wage.

Wage payment plan

1. Time rate system (non-Incentive plan)
2. Piece rate system (Incentive plan)

Time rate system - An employee is paid on basis of time worked

$$\text{Wage} = \text{Number hrs worked} \times \text{Rate/hr}$$

$$\text{Number of hrs worked} = 8$$

$$\text{Rate/hr} = \text{Rs } 50$$

$$\text{Wage} = 8 \times 50$$

$$= \text{Rs } 400/-$$

Piece rate system - An employee is paid on the basis of piece produced

$$\text{Wage} = \text{No. of pieces produced} \times \text{Rate/piece}$$

$$= 10 \times 50$$

$$= \text{Rs } 500/-$$

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Difference between Time rate and piece rate system

Time rate System

Piece rate System

1. Wages are paid on the basis of time spent on job.	Wages are paid on the basis of number of units produced
2. There is a guarantee of certain minimum wage to every worker.	There is no guarantee of minimum wage to every worker.
3. Wages are not linked with efficiency of worker. Production is low.	Wages are linked with efficiency of worker. Production is high.
4. Quality of work is high.	Quality of work is low.
5. Close supervision is required so that workers do not waste their time.	Close supervision is not required.
6. Maintenance cost is less as machines and equipments.	Maintenance cost is high.
7. Employer and trade unions support this system.	Employer and efficient employees support this system.

Essential requirements of a good wage system

To increase productivity, reducing costs

Improving efficiency, employee earning & employees' morale

1. Easy - It should be easy to understand

2. Equality - A good wage system

should treat all employees equally. Equal pay for equal work

3. Economy - It should be economical and competitive

4. Guarantee of Minimum wages A good incentive system should ensure minimum wages to every worker per month.
5. Incentive — It should provide incentive to efficient worker to motivate.
6. Flexibility — A good wage system should be flexible so that wages may be increased or decreased without making worker dissatisfied.
7. Worker's participation — It is installed for workers benefit. Management should must discuss with employees and their representative.

Objectives of Good Incentive plan

It increases competition among workers by giving reward for best work.

morale of workers

The objectives of a good incentive plan as follow -

1. It should be profitable to both workers and Management.

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2. It should reward workers in proportion of their output.
3. It should boost up morale of workers.
4. It provides opportunity to workers to earn more money.
5. It should be helpful in proper utilization of resources like, Money, Raw materials, Equipment and other related services.
6. It reduces idle time.
7. It should able to reduce labour turn over and absenteeism.
8. It improves relations between workers and Management.

Wage Incentive plan

1. Straight piece rate system.
2. Straight piece rate with minimum wage.
3. Taylor's Differential piece rate system.
4. Merrick Differential piece rate system.
5. Grant H. plan
6. Halsey plan
7. Rowan plan
8. Beauchamp plan
9. Emerson's Efficiency plan
10. Group incentive plan.

Some Important Incentive plan

Taylor's Differential piece rate system

1. Standard production rate (hourly or daily)
2. Two wage rates such as

R_H = High wage rate

R_L = Lower wage rate

In this method of wage payment, if worker's production rate is less than standard rate he will be paid according to lower wage rate R_L . He is paid to higher wage rate when production rate is ~~higher~~ equal or higher than standard rate.

- Halsey's plan
- ① Minimum wage is guaranteed
 2. Additional bonus is paid to workers
 3. Standard time is fixed for work of
 4. When workers takes less time than standard time he is paid to extra payment

$$W = R \times T + \frac{P}{100} (S-T) \times R$$

R = hourly wage Rate

T = actual time taken to complete the job

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S = Standard time



For 50-50 Halsey plan

$$W = RXT + \frac{1}{2}(S-T) \times R$$

Rowan plan - It is like
Halsey plan

Bonus is paid according to

In Rowan plan

$$W = RXT + \frac{(S-T)}{S} \times R$$

R = hourly wage rate

T = actual time

S = Standard time

Bedaux plan - Bedaux introduced
new term B represents unit of work

$$W = RXT + \frac{(Ns-NT)}{60} \times \frac{75}{100} \times R$$

R = hourly wage rate

S = Standard time

N_s = Standard time number of
points for that job.

N_T = Number of B 's earned

Production & Productivity.

Assignment -

Very Short Answer Questions:

1. Define productivity
2. Define Production.
3. Write full form of N.P.C
4. Write two factors for improving productivity.

Short Answer Questions.

1. Write internal and external factors which affect productivity.
2. Differentiate between Production and Productivity
3. What is contribution of standardisation in improving productivity?

Long Answer Questions.

1. Explain Cause of low productivity.
2. Explain the methods of improving the productivity
3. Explain the factors which affect production.

Work Study Assignment.

Very Short Questions.

1. Full form of I.L.O
2. Name techniques of Work Study
3. Define Method Study
4. Define Work Measurement
5. Define Work Study

Short Questions:

1. Write objectives of Work Study
2. Advantages of work study
3. Role of work study in improving productivity.

Long Answer Questions.

1. Explain relationship between Method Study and Work Measurement
2. Explain Scope of work study
3. Explain factors which are considered for selecting a job for work study
4. Explain human aspects of work study.

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Unit - 3 (Assignment)

Very Short Questions:

1. Define method study.
2. Draw the symbols of operation, Inspection, Transportation, Symbol of Delay, Permanent Storage
3. Define chart, flow process chart
4. Name different types of flow process chart
5. What is two handed process chart?
6. What is flow diagram?
7. What is string diagram?

Short Answer Questions:

1. Write the objectives of Method Study.
2. Name different types of process Charts.
3. Name different types of Diagrams.
4. Write notes on Cycle graph and chromacycle graph.

Long Answer Questions:

1. Explain procedure of method study.
2. Draw a man type flow process chart.
3. What is two handed process chart?

Explain with example.

4. What is flow Diagram? Explain the procedure for its drawing
5. What is string Diagram? Explain the procedure for its drawing.

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Motion Analysis.

1. Define motion Analysis.
2. What is objective of Motion Analysis?
3. Who suggested Thorblig?
4. Full form of SIMO
5. Draw the symbol of Search, Find, Graph, hold, Assemble, Disassemble, Inspect, Rest, plan
6. Express work in terms of Minute.
7. Define Ergonomics.
8. Define maximum working Area.

Long Answer Questions.

1. Explain the principles of motion economy.
2. Explain SIMO chart with Example.
3. Define motion Analysis. Explain its procedure.
4. Define Ergonomics. what are its objective?
5. Explain Application of Ergonomics.

Unit - 5 (Assignment)

Work Measurement

Very short answer questions.

1. Define work Measurement.
2. Define Time Study.
3. Name time study equipment.
4. Define Standard time.
5. What is Stop watch.
6. Define performance rating.
7. Write full form of P.M.T.S
8. Name various types of allowances.
9. What is Standard data? Define work Sampling.
10. Normal time = $\dots \times \frac{\text{Performance level of worker}}{\text{Standard performance Level expected}}$

Short Answer Questions:

1. Name different Techniques of work Measurement.
2. Name different techniques of performance rating.
3. Compare Standard data with individual time studies.
4. Procedure of work Sampling.
5. Advantages and Disadvantages of Work Sampling and Application of Work Sampling.

Long Answer Questions:

1. Define work measurement. Explain its objectives.
2. Explain Stop watch and its types briefly.
3. Explain allowances and their types.
4. What is Standard data? what are different types? Explain.
5. Define work Sampling. Explain its procedure.

Very Short Answer Questions.

1. Define wage.
2. Name different types of wages and Define all wages.
3. Name wage payment systems.
4. Define Incentive.
5. Name types of Incentives.

Short Answer Questions.

1. Explain time rate system and piece rate system of payment.
2. Explain financial and non financial incentives.
3. Explain Halsey plan.
4. Explain Rowan plan.

Long Answer Questions

1. Write advantages and disadvantages of time rate system.
2. Write advantages and disadvantages of piece rate system.
3. Compare time rate and piece rate systems.
4. Explain essential requirements of good incentive wage system.
5. Write objectives of a good wage incentive plan.
6. Define Incentive. What are different types? Explain.
7. Explain Bedaux plan.
8. Write advantages and disadvantages of Group Incentive plan.

Unit - 7 (Assignment)Production Planning and ControlVery Short Answer Questions

1. Write full form of PPC.
2. Define Production Planning and control.
3. Define Scheduling, Routing.
4. Define Despatching, Loading.
5. Write purpose of Routing and purpose of scheduling.
6. Name types of Schedules and types of Despatching.
7. Define Activity. Types of activities.
8. Define EST, LS, Slack / Float.
9. Write full form of PERT, CPM.
10. Define optimistic time, pessimistic time, most likely time.
11. what is continuous, Mass, process production.

Short Answer Questions

1. Write the functions of planning production, planning and control.
2. Write the factors which affect scheduling.
3. Write advantage & disadvantages of Scheduling.
4. Write advantages of CPM.

Long Answer Questions

1. Write objectives of production planning.
2. Write objectives of Production planning and control.
3. Explain Despatching and its procedure.
4. Write advantages and disadvantages of PERT.
5. Differentiate between PERT and CPM.
6. Explain different types of production.

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Unit - 8 (Assignment)

Stores Management

Very Short Questions:

1. Define Store.
2. Define Store Keeping.
3. Name types of stores.
4. What is a good store layout?
5. Define Inventories.
6. Name types of Inventories.
7. Define Inventory Control.
8. Define Bin Card.
9. Full form of E.O.Q.

Short Answer Questions:

1. Write short note on Centralised and Decentralised Store.
2. Write the advantages of good Inventory control.
3. Draw a Sample store ledger.

Long Answer Questions:

1. What is store. Different types of store. Explain.
2. What is Inventory? What are its different types? Explain.
3. Write the factors which are taken into consideration while planning the store layout.
4. Explain purchase procedure in Industry.

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