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(1) Prepare operation process chart (OPC) for given assembly.

(2) Prepare flow process chart (FPC) and flow diagram for given assembly for OPC.

(3) Prepare man and machine chart for given situation.

(4) Calculate standard time for a given job using performance rating technique.

(5) Select the data source and prepare a frequency distribution curve.

(6) Construct $\bar{x}$ and R chart for given process.

(7) Construct P - chart for given process.

(8) Construct C - chart for given product.

(9) Decide about acceptance or rejection of a given lot of particular product using Double sampling plan.

(10) Proof of Acceptance Sampling.

INDUSTRIAL ENGINEERING (3351904)

EXPERIMENT NO. 1

AIM : Construct an outline process chart of a given assembly.

DEFINITION : An operation process chart or outline process chart is a graphical representation of a process. It shows in chronological order operation, inspection, time allowed, if available and specification of material used in manufacturing process. From raw material stage to the finished product stage. The symbols used in this chart are : (1) Operation, (2) Inspection, which are explained as under :

(1) **Operation :** ◯ When part changes in its physical or chemical characteristics, it is termed as an operation. It is a step in a process usually done at one work-station. Every operation completed brings a step nearer to its completion. An operation is denoted graphically on process chart by a circle.

(2) **Inspection** □ When a part is checked for the specified quality or quantity during or after the process, it is termed as an inspection. An inspection does not take the part under process anywhere nearer to its completion. It only verifies whether the work has been done according to specification or not. Inspection is denoted graphically on process chart by a square.

CONSTRUCTION OF AN OPERATION PROCESS CHART :

The first step in constructing operation process chart is to design a suitable Performa as shown in fig., which gives identifying information such as the name of the part, number required, part no. and drawing no. Name of the operator, Name of the analyst, method used (present or proposed) and the time and date of the study. Additional information such as department of study, environmental condition and a summary of operation and inspection may be included if desired.

The next step is to study various components of the assembly and decide at the major component around which the whole assembly is centered. This component should be placed on the right hand corner of the sheet and every operation and inspection done on it should be serially numbered and placed within their respective symbols. These symbols are joined by horizontal and vertical lines called the material lines and flow lines respectively, forming operation process chart.

Figure shows operation process chart for the knuckle joint assembly. Assembly consists of the five components – (1) Fork. (2) Eye (3) Pin (4) Washer (5) Split Pin.
On completion of operation process chart, summary should be recorded in the space provided on the left hand bottom corner.

FORMAT FOR OPERATION PROCESS CHART

OPERATION PROCESS CHART

Operation : Assembly of Knuckle Joint

Chart No. :

Drawing No. :

Chart begins : Drawing material from store.

Location : Assembly Section.

Chart End : Assembly returned to store.

Method : Present / Proposed.

Charted by : Date :

Approved by : Date :

SUMMARY

ACTIVITY	PRESENT	PROPOSED	SAVING
OPERATION			
INSPECTION			
TOTAL			

INDUSTRIAL ENGINEERING (3351904)

EXPERIMENT NO. 2

AIM : Construction of a Flow Process Chart for a given part.

It may be observed that an Operation Process Chart gives an overall picture of a process. But, for economic production and proper layout, more information regarding movement of men and material, storage and delays is needed. This can be obtained from a Flow Process Chart. In general, a Flow Process Chart contains considerable more information than an Operation Process Chart.

According to ASME, Flow Process Chart is defined as – "A graphical representation of all Operations, Inspections, Transportations, Delays and Storages occurring during a process or procedure and it also includes distance traveled and the time taken during the activities."

There are three types of Flow Process Charts :

1) Man type Flow Process Chart records the work and movements of operators.
2) Material type Flow Process Chart presents sequence of the events as to what happens to the materials.
3) Equipment type Flow Process Chart shows how the equipment is utilized.

A Flow Process Chart is constructed in the same way as an Operation Process Chart except with the addition of the following three symbols :

⇨ : Transportation, indicating movement of men, materials or equipments from one place to another.

D : Indicates a temporary storage in the sequence of operations. This occurs when a part is to be stored temporarily between two consecutive operations.

▽ : Permanent storage indicates a controlled storage in which material in put or issued from a store under some form of authorisation.

USE OF FLOW PROCESS CHART :

It will be observed from the foregoing description that a Flow Process Chart is more detailed than an Operation Process Chart. It records all facts pertaining to the process. Thus, one of its objectives is to visualise the complete sequence of events in a process. This enables one to improve layout of the machinery and equipments, thus reducing the movements of raw materials, finished products and men. A precise study and analysis of these records may further reduce some operations and inspections, delays and storages and may suggest an improvement in the Material Handling Facilities.

Figure shows a Flow Process Chart for the manufacture of a knuckle joint fork. This is a Man type Flow Process Chart. On completion of Flow Process Chart, summary should be recorded in the space provided on the right hand side top corner of the chart.

FORMAT FOR FLOW PROCESS CHART

FLOW PROCESS CHART

Chart No:-	Sheet No:-	Summary			
Product/Material/Man		Activity	Present	Proposed	Saving
Activity:-Prepare Fork of Knuckle Joint		Operation O			
		Inspection □			
Method:- Present/Proposed		Transportation ⇨			
Location:-		Delay D			
Charted By:-		Storage ▽			
Approved By:-		Total			

Sr No	Description of Process	Qty.	Distance	Time	O	□	⇨	D	▽
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

INDUSTRIAL ENGINEERING (3351904)

EXPERIMENT NO. 3

AIM : Construction of Man-Machine Process Chart.

OBJECTIVE : When operator is performing a job on a machine, the student, on the basis of observation will –

1. Record the activities performed by the operator,
2. Measure the time for each activity recorded,
3. Measure the time during which the machine is remaining idle, during the cycle.
4. Calculate the percentage utilization of man and machine.
5. Prepare the Man-Machine Process Chart.
6. Analyze the chart prepared, with a view to increase the percentage utilization.

THEORY :

The Man-Machine Process Chart provides the information regarding the activity of Man-Machine on common time scale. It also provides the information regarding the idle time of man and machine, knowing which, one can suggest ways and means to utilize the idle time so that utilization of man and machine can be increased without much expenditure. In short, Man-Machine Process Chart helps us to increase percentage utilization of man and machine.

PROCEDURE :

1. Study the given situation and break up the job into different activities of man and machine.
2. Make preliminary entries on the man-machine process chart.
3. Record the activities being performed by the man and machine during cycle using common time scale.
4. Complete the man-machine chart to scale.
5. Calculate the cycle time.
6. Calculate the working time and idle time of man and machine.
7. Calculate percentage utilization of man and machine.
8. Draw a chart upto one man - three machines and find out whether percentage utilization of any one or both can be increased.
9. Prepare summary for all charts.

SIGNIFICANCE :

This type of chart would be used to study an activity which involves a man working with an automatic or semi-automatic machine, when the analyst is interested in determining whether the man or machine idle during any portion of the work cycle sometimes, the study may reveal that the situation could be improved by engaging more machine, if this idle time is more, the final decision however depends on the savings affected.

GIVEN SITUATION : Following activities classification is done for the automatic threading operation on a given job :

S. No.	Activity	Time min.
1	Leading of the job on the machine tool.	2
2.	Starting Machine for auto-threading.	9
3.	Unloading of the job from the machine.	1
4.	Inspection of the completed job.	2

MAN AND MACHINE PROCESS CHART						
Chart No:-				Sheet No:-		
Product:- Automatic Turning of the job				Machine :- All Geared Lathe		
Operator:-						
Charted By:-						
Sr No	**Man**			**Machine**		
	Activity	Symbol	Time	Activity	Symbol	Time
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						

Summary				
	Present		**Proposed**	
	Man	Machine	Man	Machine
Idle Time				
Working Time				
Cycle Time				
% Utilization				

INDUSTRIAL ENGINEERING (3351904)

EXPERIMENT NO. 4

AIM : Calculate standard time for a given job using performance rating technique.

EQUIPMENTS : Stop Watch, Time Study Forms, Pack of playing cards, measuring tape.

WHY IS PERFORMANCE RATING REQUIRED ?

Our day to day experience shows that, human abilities to do identical work differ very much as such, the time taken to do the same job by different persons varies considerably. A survey of number of industries where time study has been conducted has also shown that, there is considerable variation in the output of each worker. In general, it is observed that the ratio of time taken by the slowest worker to that taken by the fastest worker is approximately 2 to 2.25. So, considerable thought has to be given in the determination of standard time.

DEFINITION :

Rating is the assessment of the workers' rate of working, relative to the observers' concept of the rate corresponding to standard performance.

By definition, rating is a comparision of the rate of working observed by a Work Study Man with picture of same standard level which he is holding in his mind. This standard level is the average rate at which qualified workers will naturally work at a job when using the correct method and when motivated to apply thoroughness to their work. This rate of working corresponds to what is termed as the Standard Rating and is denoted by 100 on the rating scale.

PROCESS OF CALCULATING STANDARD TIME OF A GIVEN OPERATION :

Operations :

1) A pack of 52 playing cards is dealt in four piles.
2) Before commencing a Time Study, all information to identify the part studied, the equipment used, Operator, Analyst, working conditions, etc. should be entered in the Time Study Sheet.
3) Decide the number of observations to be made.
4) Choose the method of observing the time and record the observed time for each student in the Time Study Sheet.
5) Rate the student while performing operation in the Time Study Sheet.
   Performance Rating = (Normal Time x 100) / (Observed Time).
6) Determine basic time requirement for the operation from observed time and performance rating.
   Basic Time = (Observed Time x Performance Rating) / 100

7) Add various allowances in the basic time and compute standard time for the operation :
    - Contingency Allowance = 5% of Basic Time.
    - Relation Allowance :
        a. Constant Allowance = 9% of Basic Time
        b. Variable Allowance = 3% of Basic Time.
    - Special Allowance = 7% of Basic Time.

TIME STUDY SHEET

DEPARTMENT :

OPERATION : Distribute 52 Card in four equal part

ANALYST :

Sr. No.	NAME	OBSERVED TIME (s)	PERFORMANCE RATING	BASIC TIME (s)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

INDUSTRIAL ENGINEERING (3351904)

EXPERIMENT NO. 5

AIM : **Select the data source and prepare a frequency distribution curve.**

OBJECTIVES : The student will :

1) Measure the variable characteristics (diameter of pin with micro-meter).
2) Record the measurement in the data-sheet.
3) Make a Frequency Tally Sheet.
4) Calculate mean and standard deviation of data.
5) Construct Histogram and Frequency Distribution Curves.

RATIONALE:

A Schewart bowl is a simulation of measured products. Each marked chip represent a particular characteristic measured with the help of any measuring device. This record of markings on each chip can be considered as raw data collected from actual measurements. After collecting data, mean, standard deviation and type of distribution are found out. (Chip marks shows coded value of variable)

MATERIAL AND EQUIPMENTS :

1) Schewart bowl with its contents (chip)
2) Talley sheet
3) Calculation sheet
4) Graph papers

A Schewart bowl contains chips of different colours with making from 0 to 60.

PROCEDURE:

1. Mix the chips thoroughly in the bowl and draw one chip at random.
2. Record the number in data sheet which is on the chip, put it back in the bowl and mix again.
3. Pick up another chip and note down the number of the chip.
4. Repeat similar procedure 100 times.
5. Prepare tally sheet.
6. Decid cell width and number of cells.
7. Enter cell boundary values in appropriate column of calculation sheet in increasing order.
8. Count frequency of each cell from talley sheet and enter it in appropriate column of calculation sheet.
9. Locate the cell having maximum frequency and let mid point of this cell be as assured mean x.
10. Calculate the values of other columns and enter in appropriate place in calculation sheet.
11. Determine mean $\bar{x}$ using following formula

    $\bar{x} = x_d + i\{\sum fd / \sum f\}$, Where i = class interval ,
    x_d = Mid-point of the class where $d = 0$
12. Calculate standard deviation σ after preparing table with the use of formulae given below :

Standard Deviation = i $\sqrt{[\sum fd^2 / \sum f] - [\sum fd/\sum f]^2}$

where, $d = (x_i - x_d) / i$, i = class interval.

13. Plot histogram on graph paper using suitable scale and taking cell boundary on x-axis and frequency on y-axis.
14. Construct Frequency Distribution Curve.

SIGNIFICANCE :

Data collected from measurements, if recorded in irregular manner will be difficult to analyze. Histogram and Frequency Distribution Curves show graphical representation of collected data, which makes the interpretation of the data more effective. This chart gives what and where the variables are rather than indicating good or bad quality. This gives complete data of variation in a set of variables. It also gives an idea regarding the process and degree of variations occurring in it.

LIMITATION OF HISTOGRAM AND FREQUENCY DISTRIBUTION CURVE :

The Frequency Distribution Curve definitely provides information regarding lack of control, but proper information cannot be shown, hence it is difficult to take any decision for future control on the basis of it.

OBSERVATION TABLE

Sr No.	No on Chip	Sr No.	No on Chip	Sr No.	No on Chip	Sr No.	No on Chip
1		26		51		76	
2		27		52		77	
3		28		53		78	
4		29		54		79	
5		30		55		80	
6		31		56		81	
7		32		57		82	
8		33		58		83	
9		34		59		84	
10		35		60		85	
11		36		61		86	
12		37		62		87	
13		38		63		88	
14		39		64		89	
15		40		65		90	
16		41		66		91	
17		42		67		92	
18		43		68		93	
19		44		69		94	
20		45		70		95	
21		46		71		96	
22		47		72		97	
23		48		73		98	
24		49		74		99	
25		50		75		100	

FREQUENCY TABLE

CLASS	TALLY	FREQUENCY

CALCULATION TABLE

CLASS	FREQUENCY	CELL MID POINT	d	f.d	$f.d^2$
	$\sum f=$			$\sum fd=$	$\sum fd^2 =$

INDUSTRIAL ENGINEERING (3351904)

EXPERIMENT NO. 6

AIM : Control Chart for variables (X bar and R Chart).

OBJECTIVES : The student will :

1) Estimate all Inspection directions with the help of Schewarl's Bowl.
2) Draw Samples and record them systematically.
3) Compute data required for constructing the chart.
4) Plot x and R chart using the computed data.

MATERIAL AND EQUIPMENTS :

1) Schewarl's Bowl containing red, blue and white chips as per specifications.
2) X bar and R Chart. Construction Sheets and Graph Paper.

PROCEDURE :

- Verify the content of the Schewarl's Bowl.
- Make preliminary entries on the Calculation Sheet.
- Decide Sample size (Take sample size = 05).
- Mix the chips thoroughly in the bowl and draw one chip at random.
- Record the number in data sheet which is on the chip, put it back in the bowl and mix again.
- Pick up another chip and note down the number of the chip.
- Continue till the sample size is over.
- Repeat similar procedure for all samples.
- For each sub-group, calculate the value of $\bar{x}$ and R.
- Compute the value of mean of $\bar{x}$ and mean of $\bar{R}$.

  $\bar{\bar{x}} = \sum \bar{x} / n$, $\bar{R} = \sum R / n$, where n = Number of sample

  Calculate upper and lower contr ol limits (UCL and LCL) fo $\bar{x}$ chart.

  $\bar{x} = \bar{\bar{x}} + A_2 \bar{R}$, L$\bar{x}$– $\bar{\bar{x}} - A_2 \bar{R}$

  UCL 0.58 (from the SQC Ta LC the sample of s ze 05).

  A_2 = 58 (fr upper and l ble for (UCL able of size
- Calculate th $\bar{R}$, Lower limit $\bar{R}$ nd LCL) for R-chart.

  $UCL_R = D_4$ .11 and D_3 $CL_R = D_3$ m the SQC Tabl

  Take D_4 = 2 $\bar{x}$-chart = 00 (fro mber on e for sample of size 0 5).
- Now, draw the both the with sample num $\bar{x}$, and X-axis and $\bar{x}$ on Y -axis. Select suitable scale for b axis. Mark UCL LCL $\bar{x}$ by horizontal line from that point. $\bar{x}$ for a
- Make the value of by straig ll the sub-group, 1 to 20 on the chart.
- Join all the points by straight line.
- Now, draw the R-chart with sample number on X-axis and value of R on Y-axis. Take suitable scale for both the axes. Mark value of UCL_R and LCL_R and draw horizontal line from these points.

- Mark the value of R for all the sub-groups, 1 to 20 on the chart by dots.
- Join each dot to the days by a vertical line.

SIGNIFICANCE :

$\bar{x}$ and R charts are used by the Quality Control Department to select change in a process regarding specifications. These charts provides graphical representation of the state of a manufacturing process with respect to quality and help to decide whether the process is under control or not. They also provide guideline about when and how to take corrective measures.

As we know that the contents of Schewarl's Bowl represent normal distribution, the condition simulated for this experiment is ideal. The process is properly controlled and variations are due to chance causes only, so, if the drawing were made truly at random, it is expected that all the points in both the charts will fall within the control limits.

OBSERVATION TABLE

SAMPLE NO.	x_1	x_2	x_3	x_4	x_5	$\bar{x}$	R=Max-Min
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
						$\bar{x}$ =	$\bar{R}$ =

INDUSTRIAL ENGINEERING (3351904)

EXPERIMENT NO. 7

TITLE : Control charts for Fractional Defectives (P- Chart).

OBJECTIVES :

The students will be able to :

1. Inspect the sample to sort out defective units.
2. Compute control limits.
3. Plot the "P-Chart".

RATIONALE :

The quality characteristics of products manufactured in industries are mainly of two types – (1) Variable Quality. (2) Attribute Quality. Variable Qualities can be measured by any measuring instruments, but, attribute quality can be classified only as good or bad. The good product is accepted and bad product, which is called defective, is rejected.

The defective is defined as a product with defects. The defects in the product may be due to any spot, dent, cracks, colours, surface finish, etc. There may be one or more than one defects by which the product becomes defective. Fraction defective chart is a quality control technique by which the control limits can be detected. These charts are used for smaller consumable products like ball pen, refills, pencils, pins, buttons, nuts and bolts, etc., where passing of defective items is not so very costly.

MATERIALS :

Twenty boxes of buttons. There should be 100 buttons in each box and "P-Chart" Calculation Sheets.

PROCEDURE :

1. Distribute a box of buttons to each student.
2. Inspect each button and separate defective ones (buttons which are broken, under-size, with eccentric holes, out of shape, without holes, etc. are classified as defective.).
3. Count the total number of defective buttons and the sample size in the calculation sheet.
4. Calculate the percentage defective for each sample and post it in calculation sheet.
5. Calculate the average fraction defective $\bar{p}$.

   $\bar{p} = \sum p / N$, Where N = Number of Sample

6. Calculate the upper and lower control limits based on the largest sample size, using the following formulae :

$$UCL_p = \bar{p} + 3\sqrt{[\bar{p}\ (1-\bar{p})] / n}$$

$$LCL_p = \bar{p} - 3\sqrt{[\bar{p}\ (1-\bar{p})] / n} \quad ,$$

Where n = Sample size.

7. If LCLp work out to be negative, assume it to be equal to zero.
8. Plotting of P-Charts : Take sample on X-axis and Fraction Defective (p) on Y-Axis. Mark UCLp, LCLp and p on it and Draw Horizontal Lines. Mark all points and join them by straight line.

CONCLUSIONS :

1. If all points in graph fall within control limit, the process is under control, without assignable cause of variation.
2. If any point in graph fall outside the control limit, the process contains assignable causes of variations.

OBSERVATION TABLE FOR FRACTION DEFECTIVE CHART

SAMPLE NO.	NO. OF BUTTONS		FRACTION DEFECTIVE
	INSPECTED n	DEFECTIVE d	$\{P = \frac{d}{n}\}$
1	100		
2	100		
3	100		
4	100		
5	100		
6	100		
7	100		
8	100		
9	100		
10	100		
11	100		
12	100		
13	100		
14	100		
15	100		
16	100		
17	100		
18	100		
19	100		
20	100		
Total	2000		$\Sigma p =$

INDUSTRIAL ENGINEERING (3351904)

EXPERIMENT NO. 8

TITLE : Control charts for Number of Defects (C- Chart).

OBJECTIVES :

After completing this experiment, you will be able to,

(1) Identify nos. of defect in single unit of production.
(2) Inspect each unit of production as per standards laid down.
(3) Calculate average defect and control limits.
(4) Plot defect chart.

RATIONALE :

Defect is a characteristics of product by which it becomes defective. There may be several defects in each single unit of production. As for an example, engines manufactured on assembly lines. They may have one or more defect in each engine. Say one engine may have defect in governing system and power transmission gears. On inspection, this defect can be identified and subsequently can be rectified.

The characteristics patterns of occurance of defects in the production can be identified on defect charts, which are known as C – chart. The shape of these charts can lead us to some conclusions regarding functioning of process.

This situation is stimulated in laboratory can be stimulated by taking type written sheets and identifying number of mistakes in typing.

PROCEDURE :

(1) Distribute 10 – 15 type written sheets of papers for performing this exercise.
(2) Let each student inspect the sheets of type written papers and note down number of mistakes found in each page. This defects may be spelling mistake, overtyping, double typing, erased and retyped letters etc.
(3) Record number of mistakes found in each page in observation table.
(4) Find average defects.

$$\bar{C} = \frac{\text{Total numbers of defects in all page inspected}}{\text{Total number of page inspected}}$$

(5) Calculate the upper and lower control limits using the following formulae :

$$UCLc = \bar{C} + 3\sqrt{\bar{C}} \qquad ,LCLc = \bar{C} - 3\sqrt{\bar{C}}$$

(6) Plot C – chart, take number of mistakes found on Y – axis and page no inspected on Y – axis. Make points on the graph and join them by straight line. Show upper control limit (UCLc) and lower control limit (LCLc)

CONCLUSIONS :

1. If all points in graph fall within control limit, the process is under control, without assignable cause of variation.
2. If any point in graph fall outside the control limit, the process contains assignable causes of variations.

OBSERVATION RECORD FOR C - CHART

SAMPLE NO.	Number of defects
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

INDUSTRIAL ENGINEERING (3351904)

EXPERIMENT NO. 09

AIM : Study of Acceptance Sampling for Attributes (Double Sampling).

OBJECTIVE : The student will be able to :

1. Use IS table from 2500 (1963), Part – I-II to determine :
   a. Sample Size Code Letter.
   b. Size of First and Second Samples.
   c. Acceptance and Rejection Numbers for Samples.
2. Use Random Number Tables.
3. Inspect samples to classify them as Acceptable or Rejectable.
4. Decide as to accept or reject the lots on the basis of double sampling.

MATERIALS AND EQUIPMENTS :

1. Nails (1000 nos.).
2. Sampling Rack.
3. Data Sheet.
4. IS table from 2500 (1963), Part – I-II

PROCEDURE :

- For general inspection level II – Normal, refer IS Table and find out :
  - Code Letter.
  - Sample Size.
  - Acceptance Number for Specified AQL (Say, 6.5%).
- Enter necessary information on the top of the Data Sheet.
- Generate 3-digit Random Numbers with the help of Random Number Table.
- The first digit gives Shelf Number, second digit gives Column Number and third digit gives Row Number.
- Enter Random Numbers on the Data Sheet, for N1 items of the first sample and N2 items of the second sample.
- Pick up one by one nails from the rack as per the Random Numbers. Compare each nail with Predetermined Attribute Criteria and decide whether to accept or to reject the nail.
- Enter "A" or "R" in the Data Sheet to denote Acceptable or Rejectable as the case may be.
- Find the total number of defective items in the first sample. If it is less than or equal to "A1", accept the lot. There is no need to inspect the second sample. If it is greater than "A2", reject the lot. There is no need to inspect the second sample. If it is in between "A1" and "A2", inspect the second sample and decide whether the lot is to be accepted or rejected.

- Continue inspection for another N2 nails, forming the second sample, entering the result of inspection on the Data Sheet against each by "A" or "R".
- Find the sum of Rejectable nails in the cumulative sample "N1 + N2". If this number is less than or equal to "A2", accept the lot and if it is great er than "A2", reject the lot.

SIGNIFICANCE :

The advantages of Double Sampling lie in the possible reduction in the total amount of inspection required. It is because the first sample is smaller than that required in the Single Sampling Plan. If the lot can be accepted as a result of the first sample itself, there will be a saving in the total inspection. This is more so when the lot sizes are large and the quality of incoming material is good.

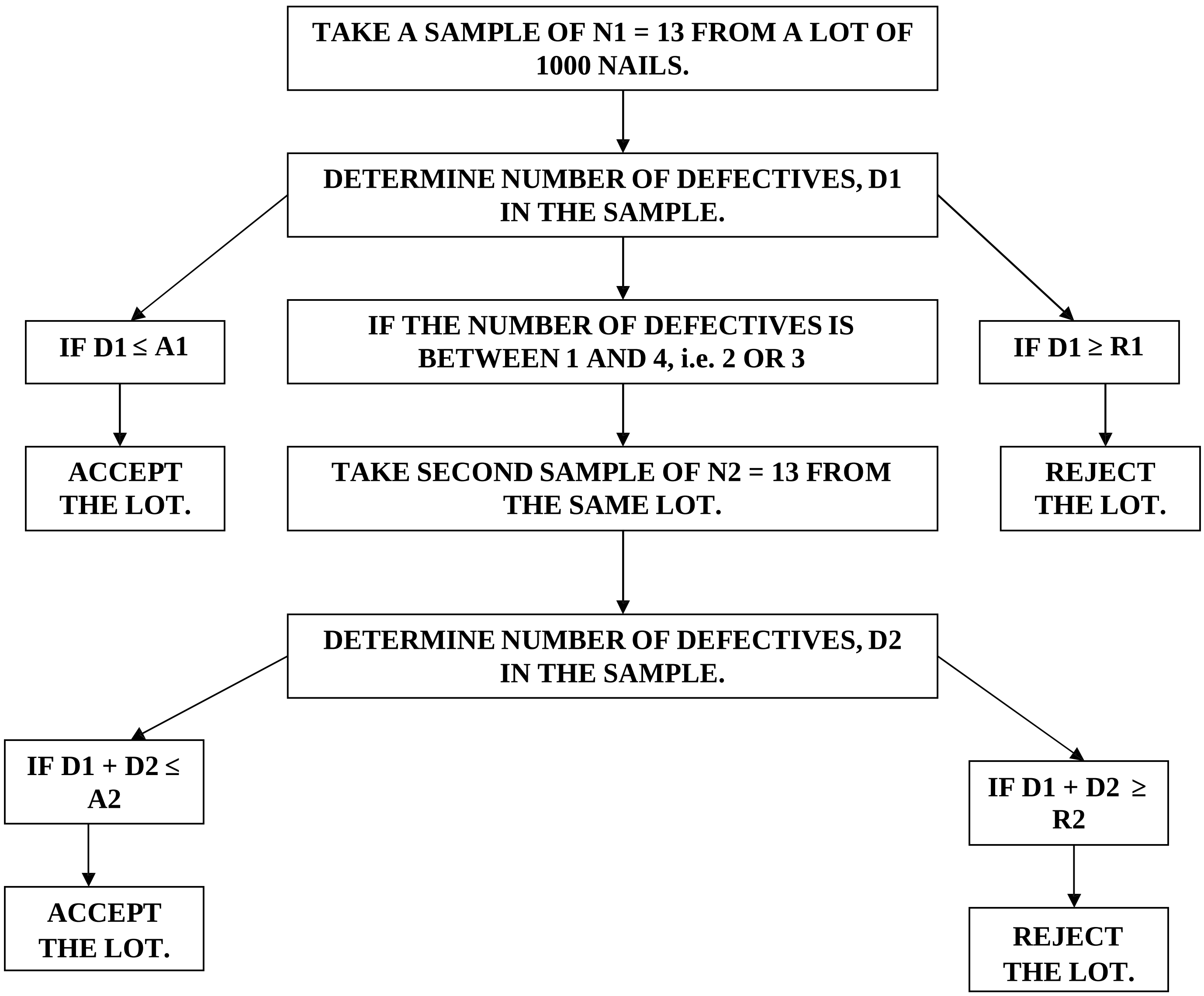
DATA SHEET

DOUBLE SAMPLING PLAN

Lot Size = 1000	Code Letter = F
Specified AQL = 6.5%	First Sample Size, N1 = 13
Level of Inspection – II	Acceptance No., A1 = 1
Rejection, R1 = 4	Second Sample Size, N2 = 3
Combined Rejection, R2 = 5	Combine Acceptance No., A2 = 4

	FIRST SAMPLE		**SECOND SAMPLE**	
S. No.	Random Number	Result A / R	Random Number	Result A / R
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				

THE WORKING OF DOUBLE SAMPLING PLAN



INDUSTRIAL ENGINEERING (3351904)

EXPERIMENT NO. 10

AIM : Proof of Acceptance sampling.

OBJECTIVES: The student will verify the following statement about sampling by simulating sampling situation.

"When random sample are taken from universe having a known percent of defectives, the same percentage of defective appear in the sample, the number of samples taken ensure the average percentage of defective in sample represent same percentage of defective in the universe."

MATERIAL AND EQUIPMENT:

Box containing 1000 beads as specified.

White	815
Green	100
Yellow	50
Red	20
Blue	10
Brown	05

(1) The colour beads taken as defectives item and white beads considered as a normal item.
(2) Wooden paddle to scoop 50 beads at a time .

PROCEDURE:

(1) Make preliminary entries on the data sheet.
(2) Shake up the box thoroughly and scoop up 50 beads with paddle.
(3) Record the number of beads of each colour in appropriate column.
(4) Put back the beads in to the box and mix thoroughly, and repeat the same procedure 200 times.
(5) Calculate the total number of each colour beads and percentage in every 25 attempt, and entered in calculation sheet.
(6) Complete calculation sheet for all 200 attempt.
(7) Draw the graph, Take sample no on X axis and % defective on Y axis take appropriate scale on each axis, draw horizontal line of known % of each colour beads, than mark points of each colour bead % and join all points.

SIGNIFICANCE :

It is observed from the graph that as the number of sample increase the % defective comes nearer to true % defective. It means that as number of sample increase the chance acceptance of defective lot becomes minimum.

OBSERVATION TABLE

Sr no	GR	YE	RE	BL	BR	Sr no	GR	YE	RE	BL	BR
1						26					
2						27					
3						28					
4						29					
5						30					
6						31					
7						32					
8						33					
9						34					
10						35					
11						36					
12						37					
13						38					
14						39					
15						40					
16						41					
17						42					
18						43					
19						44					
20						45					
21						46					
22						47					
23						48					
24						49					
25						50					

CALUCLATION SHEET

Sub Group	Observed defective beads									
	Green (10%)		Yellow(5%)		Red(2%)		Blue(1%)		Brown (0.5%)	
	No	%	No	%	No	%	No	%	No	%
1 to 25 (1250)										
1 to 50 (2500)										
1 to 75 (3750)										
1 to 100 (5000)										
1 to 125 (6250)										
1 to 150 (7500)										
1 to 175 (8750)										
1 to 200 (10000)										