



RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY
Established by Government of Central Provinces Education Department by Notification No. 513 dated the 1st of August, 1923 & presently a State University governed by Maharashtra Public Universities Act, 2016 (Mah. Act No. VI of 2017)



DEPARTMENT OF LIFELONG LEARNING AND EXTENSION

Gurunanak Bhavan, University Campus, Amravati Road, Nagpur - 440 033. Phone : 2530860
E-mail : doll.rtmnu@gmail.com

To,
The Principal
Shivaji Science College,

No.DOLLE236/19
Dated : 16.10.2019

Nagpur,

Subject : ⁹⁴²³¹⁰³⁰⁴³ Sanction for Conducting Short Term Courses under
Jeevan Shikshan Abhiyan on No Grant Basis.

Sir/Madam,

With reference to your proposal for conducting Short Term courses indicated below under Jeevan Shikshan Abhiyan of this Department, I am to inform you that your proposal has been accepted by the Department and your College has been granted permission to conduct the course on the following conditions:

Details of the Course

Sr. No.	Name of the Course	Duration	No. of Candidates to be admitted	Fees to be Charged per Student	Fees to be Deposited With the Deptt.
1	Certificate Course in Groundwater Exploration	8 Weeks	20	1200/-	10%
2	Certificate Course in Statistical Quality Control	6 Weeks	20	650/-	10%
3	Certificate Course in Immune-Diagnostics	4 Weeks	20	2200/-	10%
4	Certificate Course in Environmental and Water Management	6 Weeks	20	1000/-	10%
5	Certificate Course in Mushroom Cultivation	6 Weeks	20	1000/-	10%
6	Certificate Course in Biofertilisers and Biopesticides	12 Weeks	20	1500/-	10%
7	Certificate Course in Forestry and Wild Life Management	6 Weeks	20	1500/-	10%

Rules & Regulations of this Department regarding these courses should be strictly followed.

1. This sanction is valid for this particular Batch only.
2. Fees for the course should be charged as per the norms prescribed.
3. Expenditure on the course should be incurred as per norms.
4. Course should be started within a Month from the date of sanction.
Please communicate your acceptance within a month and submit Initial Report
Along with list of students admitted.

Dr. A. D. Bobdey
for n.a -
MBH
03-07-2020

Your's faithfully,

prateek
Director

Shri Shivaji Education Society Amravati's
Science College, Nagpur

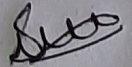
Certificate Course in

STATISTICAL QUALITY CONTROL

List of Enrolled students for the session 2018-19

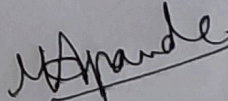
Certificate of completion of the course is issued to the following students.

S.No.	Name of students				Signature and date
1	Ku	Bobde	D	G	Danesh 16/01/2020
2		Dangre	P	K	Pragna - 22/11/2020
3	Ku	Elgunde	M	N	Elgunde 07/01/2020
4	Ku	Gharpure	Srushti	V	Gharpure 04/01/2020
5	Ku	Halmare	H	N	Halmare 17/02/2020
6		Joshi	S	M	S. Joshi 04/01/2020
7	Ku	Kadoo	P	P	Pradov 09/01/2020
8	Ku	Kalbande	N	A	Pooja Kalbande 09/01/2020
9	Ku	Kale	K	K	Palle 9/01/2020
10	Ku	Kale	V	P	Kale 7/1/2020
11		Naghate	V	N	V.N. Naghate 1/2/2020
12		Paltankar	S	S	Paltankar 9/1/2020
13		Pardhi	H	L	Pardhi 9/1/2020
14		Patel	T	M	Patel 22/01/2020
15		Totade	T	P	Totade 22/11/2020
16		Warthi	V	R	Warthi 16-11-2020



Faculty

r. Sheetal Paliwal



Coordinator

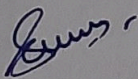
Mrs. M.A.pande

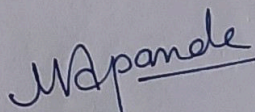
Shri Shivaji Education Society Amravati's
Science College, Nagpur
Department of Statistics
Certificate Course in STATISTICAL QUALITY CONTROL

Marksheet (2018-20)

S.No.	Name of students				Marks obtained in					Grade
					theory	internal	Practical	viva	Total	
1	Ku	Bobde	D	G	32	9	30	9	80	A
2		Dangre	P	K	34	9	30	5	78	B ⁺
3	Ku	Elgunde	M	N	39	9	30	5	83	A
4	Ku	Gharpure	Srushti	V	45	10	30	8	93	A ⁺
5	Ku	Halmare	H	N	40	9	30	5	84	A
6		Joshi	S	M	45	10	30	9	94	A ⁺
7	Ku	Kadoo	P	P	43	10	30	9	92	A ⁺
8	Ku	Kalbande	N	A	38	10	30	7	85	A
9	Ku	Kale	K	K	44	10	30	9	93	A ⁺
10	Ku	Kale	V	P	43	9	29	7	88	A
11		Naghate	V	N	30	10	30	8	78	B ⁺
12		Paltankar	S	S	29	9	28	5	71	B ⁺
13		Pardhi	H	L	46	10	30	9	95	A ⁺
14		Patel	T	M	30	10	30	9	79	B ⁺
15		Totade	T	P	30	9	29	9	77	B ⁺
16		Warthi	V	R	28	8	28	7	71	B ⁺

A⁺ : above 90
A : 80-90
B⁺ : 70-80
B : 60-70
C : 50-60
Fail: below 50


Dr. (Mrs) Sheetal Paliwal
Faculty


Mrs. M.A. Pande
Coordinator

RTM Nagpur University, Nagpur in collaboration with

SSES Science College, Congress Nagpur, 12

Department of Life Long Learning and Extension

Syllabus and Pattern of Examination of Certificate Course in
Statistical Quality Control

(With effect from the academic year 2018-2019)

The skill based Certificate Course in Statistical Quality Control for first year Statistics students has duration of 6 weeks comprises of theory and practical. The syllabus and pater of examination is as follows.

Duration: 30 hours.

Objective: To make students aware of the use of statistical techniques in maintaining and improving quality standards of products in industries.

Syllabus:

Importance of statistical methods in Industrial research and practice, Quality of a product, need for quality control, Causes of variation in quality, Process control and Product control, Tools for SQC, determination of tolerance limits, General theory of control charts, sub grouping, control charts for variables and for attributes.

Acceptance sampling by attributes, Consumers' risk, Producers' risk, AOL, AOQL, LTPD, ASN, OC, Single and Double Sampling Plans.

Practical: Problems on construction of various control charts and on sampling inspection plans.

Pattern of Examination:

Course	Papers	Marks				Total marks
		Theory	Internal assessment	Practical		
				problems	Viva	
Certificate Course in Statistical Quality Control	Theory: Statistical Quality Control Practical : based on construction of control charts and sampling inspection plans	50	10	30	10	100

Note: Internal marks are based on assignments and practical work done by the students.

Department of Statistics

Certificate Course in Statistical Quality Control

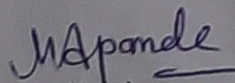
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Acceptance sampling by attributes, Consumers' risk, Producers' risk, AOL, AOQL, LTPD, ASN, OC, Single and Double Sampling Plans. Problems on construction of control charts and on sampling plans.


Head

Department of Statistics

Department of Statistics
Shivaji Science College
Congress Nagar, Nagpur.

S.S.E.SAmT's Science College, congress Nagar, Nagpur
 Certificate Course -Statistical Quality Control- Practical

Exercise No.-01

Title: Drawing of control charts for mean and range Date:

1. The following data gives the measurement of axle of bicycle wheel .12 samples were taken so that each sample contains the measurements of 4 axles obtain that control limit for \bar{X} and R charts comments whether the process is under control or not.

Sample No.	Sample Values			
	1	2	3	4
1	139	140	145	144
2	140	142	142	139
3	142	136	143	141
4	136	137	142	142
5	145	146	146	146
6	146	148	149	144
7	148	145	146	146
8	145	146	147	144
9	140	139	141	138
10	140	140	139	139
11	141	137	142	139
12	138	140	144	138

2. Construct a control charts for mean and range for the following data and comment on whether the production seems to be under control ,n=5

Sample No.	Sample Mean \bar{X}	Range R
1	761.0	47.0
2	766.0	31.0
3	760.0	32.0
4	775.0	22.0
5	788.0	7.0
6	775.0	32.0
7	760.0	21.0
8	763.0	18.0
9	768.0	27.0
10	766.0	17.0
11	769.0	38.0
12	766.0	35.0
13	766.0	17.0
14	769.0	26.0
15	774.0	14.0
16	758.0	24.0

S.S.E.SAm't's Science College, congress Nagar, Nagpur
 Certificate Course - Statistical Quality Control - Practical

Exercise No.-02

Title: Drawing a control charts for mean and standard deviation

Date:

1. Following data give the reading for 10 samples of size 6 in the production of some components.

Sample No.	Mean	Std.Dev.
1	383	30.5
2	508	41.6
3	505	39.5
4	582	32.2
5	557	27.4
6	337	24.2
7	574	48.7
8	614	8.9
9	707	13.1
10	753	33.9

$A1=1.41, A2=0.483, B3=0.03, B4=1.97$

2. In a glass factory the task of quality control was done with the help of \bar{X} and σ charts for 18 samples of 10 items each. Determine the 3σ control limits for \bar{X} and σ chart.

$\sum \bar{X}_i = 595.8, \sum s_i = 8.28, A1=1.03, B4=1.$

3. Following data gives the reading for 7 samples of size 6 in the production

Sample No.	Mean	Std.Dev.
1	384	30.5
2	482	42.5
3	258	27.5
4	621	48.2
5	398	51.2
6	457	62.2
7	672	67.5

$A1=1.41, A2=0.483, B3=0.03, B4=1.97$

S.S.E.SAmt's Science College, congress Nagar, Nagpur

Certificate Course- Statistical Quality Control - Practical

Exercise No.-03

Title: Construction of control charts for attributes

Date:

1. The following data gives the no. of defectives in 10 independent samples of varying sizes from a production process

Sample no.	Sample size(ni)	No. of defective(di)
1	2000	425
2	1500	430
3	1400	216
4	1350	341
5	1250	225
6	1760	322
7	1875	280
8	1955	306
9	3125	337
10	1575	305

Draw a control chart for fraction defectives and hence comment on the state of control of the process.

2. Construct a control chart for the proportion of defective obtained in repeated random sample size 100 from a process which is considered to be under control when the process true proportion of defective 'p' is equal to 0.20 .Draw the control line and UCL & LCL on graph paper.
3. In a factory producing spark plug the number of defectives found in each inspection of 20 lots of 100 each is given below .Construct a np-chart and comment.

5, 10, 12, 8, 6, 4, 6, 3, 3, 5, 4, 7, 8, 3, 3, 4, 5, 8, 6, 10.

S.S.E.SAmt's Science College, congress Nagar, Nagpur
 Certificate Course- Statistical Quality Control - Practical

Exercise No.-04

Title: Construction of control charts for attributes

Date:

1. The following data refer to visual defects found during inspection of the 1st 10 samples of size 100 each. Use them to obtain UCL & LCL for percent defective in sample of 10

Sample no.	1	2	3	4	5	6	7	8	9	10
No. of defectives	4	8	11	3	11	7	7	16	12	6

2. Samples of fabrics from textile mill each 100 meter square are selected & no. of occurrences of foreign matter recorded. Data for 25 samples are shown in the following table. Construct c-chart for no. of nonconformities.

Sample No.	Nonconformities	Sample No.	Nonconformities
1	5	14	11
2	4	15	9
3	7	16	5
4	6	17	7
5	8	18	6
6	5	19	10
7	6	20	8
8	5	21	9
9	16	22	9
10	10	23	7
11	9	24	5
12	7	25	7
13	8		

3. Below are the average numbers of outlet leaks per radiators each. Construct U-chart and comment

15, 17, 12, 16, 14, 5, 14, 11, 9, 10.

Shri Shivaji Education Society Amravati's
Science College, Nagpur

Shri Shivaji Education Society Amravati's Science College, Congress Nagar, Nagpur

DEPARTMENT OF STATISTICS

Time Table for the Certificate course examination -2019

	DAYS	TIME
THEORY	FRIDAY	10:00AM -01:00PM
PRACTICAL	SATURDAY	11:30AM-1:30 P.M.

M. A. Pande

S.S.E.SAmt's Science College, congress Nagar, Nagpur

Department of Statistics

CERTIFICATE COURSE IN STATISTICAL QUALITY CONTROL

2018-19

TIME: 3 hours

Date: 12th July 2019

Marks: 50

NOTE: Attempt any 4 questions. Question no. 5 is compulsory

Q1. What is SQC? Explain its importance in the success of organization? Also explain

- (i) Chance causes and Assignable causes
- (ii) Process control and Product control (12)

Q2. Discuss the control charts for mean when i) standards are given
ii) standards are not given (12)

Q3. Discuss p and np chart. (12)

Q4. Explain the procedure of single sampling plan. (12)

Q5. Solve any 7 of the following.

- a) Who developed control chart technique?
Define the following terms
- b) Producer's risk
- c) Consumer's risk
- d) Operating characteristic
- e) Acceptance quality level
- f) Average outgoing quality
- g) Lot tolerance fraction defective
- h) State the probability distribution of no. of defects (c) (14)

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Shri Shivaji Education Society Amravati's Science College, Nagpur
 Department of Statistics
 Practical Examination (2018-19)
 Certificate Course in Statistical Quality Control
 Time: Three Hours } Date : 13th July 2019 {Maximum marks: 30

Note: Solve any three questions. All questions carry equal marks. Verify your answer using any software.

Q 1. Construct (\bar{X}, R) chart for the following data & comment on the process.

Sample no.	1	2	3	4	5	6	7	8	9	10
Observations	21	36	35	39	23	36	33	23	29	36
	31	48	21	22	25	52	15	30	30	37
	39	19	20	24	46	30	40	20	39	39
	25	41	34	29	29	28	29	19	31	32

Q.2. In the final inspection of cars manufactured in a factory each car is checked for minor defects. A brief study was made to see if the no. of minor defects was relatively constant and under control. The results of first twelve units checked are given below.

unit no.	1	2	3	4	5	6	7	8	9	10	11	12
no. of defects C_i	4	3	7	4	5	5	4	5	7	8	6	7

Construct the appropriate chart for this purpose and comment on the state of control.

Q.3. In a single sampling plan with $N = 200$, $n = 20$, $c = 4$,
 Evaluate $L(p)$ using Binomial expansion and draw O. C curve.

Q. 4. To examine the quality of an engineering product, 10 samples of 200 items each were taken from a days production and the number of defective items in each sample was recorded as follows :

Sample no.	1	2	3	4	5	6	7	8	9	10
No. of defectives	14	20	36	42	22	18	26	2	12	8

Draw control chart for fraction defectives and state whether the process is under control or not.

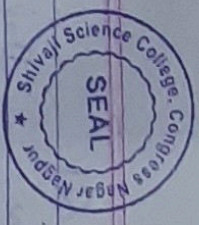
Q.5. In a factory producing spark plug the no. of defectives found in inspection of 20 lots of 100 each is given below. Construct appropriate control chart & comment.

5, 10, 12, 8, 6, 4, 6, 3, 3, 5, 4, 7, 8, 3, 3, 4, 5, 8, 6, 10

Seat No. 1-1

SCIENCE COLLEGE, CONGRESS NAGAR, NAGPUR.

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B.Sc. Semester I / II / III / IV / V / VI

Roll No. : 1

Section : A / B / C / D

Name : DEVESH . S . BORDE

Group : SEM

Subject : Cellulose Chemistry in SOL

Batch : MB

Paper : _____

Day : Saturday

Date : 12-01-2013

For Examiner

Instruction to Candidates

Maximum Marks

50

1. Fill in all the entries neatly and correctly immediately after receiving the answer book.

Marks Obtained

31

2. Write on both side of the page.

Remarks

3. Students using unfair means will not be allowed to appear for the examination and his/her name will be reported to the the Principal for necessary action and his/her name will be reported to his/her parent/guardian.

Signature of Valuer

[Signature]

4. Bring your identity card.

31
50

Statistical Quality Control (SQC) is a branch of industrial quality management techniques by which quality of manufactured product is maintained by statistical techniques.

Quality Management:-
By using this technique, we can check the quality of manufactured product, increasing material and production of returning.

Use of historical records to get the quality records to maintain the quality of product.

Training the number of defective product by plotting points on the control chart for sample of the points are in control limits. Also, the control chart is also used to detect the error in process.

When the error in process is detected, the error can be reduced.

By SAC techniques.

1) Cause causes:-
Sometimes, there are some causes which are called variation. Some are not controlled by the process. Some are called common causes. The causes of this variation are natural causes. Variation occurs due to not controllable. Some minor causes are not controllable. Some minor causes are controllable. Some minor causes are controllable. Some minor causes are controllable.

2) Variation in process:-
Variation in process is the change in the quality of the product. It is caused by the change in the process. It is caused by the change in the process. It is caused by the change in the process.

3) Inspection in checking of machine working:-
Inspection is the process of checking the quality of the product. It is done by the inspection. It is done by the inspection. It is done by the inspection.

4) Control chart:-
Control chart is a statistical tool used to monitor and control a process. It is used to detect the variation in the process. It is used to detect the variation in the process. It is used to detect the variation in the process.

5) Sampling:-
Sampling is the process of selecting a small number of units from a large population. It is used to estimate the quality of the population. It is used to estimate the quality of the population. It is used to estimate the quality of the population.

Assignable causes:

Process Control: Some during processing of product while planning points are outside the control limits, then process is out of control.
When the points are inside control limits then the process is under control. If there is fluctuation, process control procedure is done by quality assignable cause.

(106) Product Control: Due to change cause occurs variation in the quality of products. Assignable cause is used for checking the quality of products.

Control charts for mean are introduced by control charts for mean are introduced by W.A. Shewhart with standard control charts for mean are of two types \bar{X} and R charts (\bar{X} = mean, R = Range) for \bar{X} and σ charts. If standards are given

$$E(\bar{X}) = \mu$$
$$V(\bar{X}) = \frac{\sigma^2}{n}$$
$$S.E(\bar{X}) = \frac{\sigma}{\sqrt{n}}$$

If standard are given

$$UCL = E(\bar{X}) + 3 S.E(\bar{X})$$
$$= \mu + 3 \frac{\sigma}{\sqrt{n}}$$

$$CL = \bar{X} = \mu$$

$$LCL = \mu - 3 \frac{\sigma}{\sqrt{n}}$$

Q3

P-charts is used for fraction defectives
p-charts on np charts is used for
defectives product only
p-charts & np-charts follows binomial
distribution
for p-charts

$$P \sim B(n, p)$$

$$E(P) = np$$

$$V(P) = npq$$

$$S.F.(P) = \sqrt{npq}$$

$$\text{where } q = 1 - p$$

when standard are given

$$p = p'$$

$$LCL = E(P) - 3[S.F.(P)]$$

$$CL = E(P) = np'$$

$$UCL = E(P) + 3[S.F.(P)] \\ = np' + 3\sqrt{np'q}$$

ii) when standard are not given

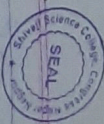
$$LCL = E(P) - 3[S.F.(P)] \\ = np - 3\sqrt{npq}$$

$$CL = E(P) = np$$

$$UCL = np + 3\sqrt{npq}$$

5

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Q5

Ans-a) Walter A Shewhart developed control chart technique.

Ans-b) The rejection of huge quantity of product at the inspection stage is called as process risk.

Ans-c) Buying a new product which is called as consumer risk possibly defective product is called as consumer risk.

Ans-d) The operating characteristics (O.C) is the mathematical expression (CP) showing variation of p, the fraction defective of the lot.

Ans-e) A lot with relatively small fraction defective say p1 will be good run as lot with small proportion of defectives is rejected as a good lot. Usually probability of rejecting a lot of quality p1 is very small. O.C

B.Sc. Semester I / II / III / IV / V / VI

Section : A / B / C / D

Group : SCB

Batch : 178

Day : Friday

For Examiner

Maximum Marks

Marks Obtained

Remarks

Signature of Valuer

Roll No. : 1

Name : Dhanraj S. Babbar

Subject : Certificate course in

Paper : 1

Date : 12-07-2017

Instruction to Candidates

1. Fill in all the entries neatly and correctly immediately after receiving the answer book.
2. Write on both side of the page.
3. Students using unfair means will not be allowed to appear for the examination and his/her name will be reported to the Principal for necessary action and his/her name will be reported to his/her parent/guardian.
4. Bring your identity card.

Q1. Registering a lot of quality $P_1 = 0.05$

Q2. Sampling a lot of quality $P_1 = 0.95$

P_2 is called acceptance quality level.

Quality defectives is

average expected fraction of sampling is

is called average outgoing of quality is

is is represented by

\bar{p} - (average no. of defectives after

operation of sampling plan)

Ans. Poisson distribution is the probability distribution of no. of defects (C)

Q4

Single Sampling Plan about accepting or the

If the fraction of lot is taken as the

rejection of one sample only, the

basis of one sample as attribute is

acceptance sampling plan.

Lot A N is the lot size N is number

of items in the sample size n is number

of items in the acceptance plan is number

of items in the rejection plan is number

of items in the sample N is number

of items in the lot of size N is number

of items in the lot of size N is number

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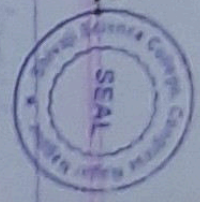
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Roll No. : 1

Section : A/B/C/D

Name : DEVESH . M. BORDI

Group : SEM

Subject : Geographical Course in SAC

Batch : M8

Paper : _____

Day : Saturday

Date : 13-07-2019

For Examiner

Maximum Marks _____

30

Marks Obtained _____

30

Remarks _____

Signature of Valuer _____

[Signature]

Instruction to Candidates

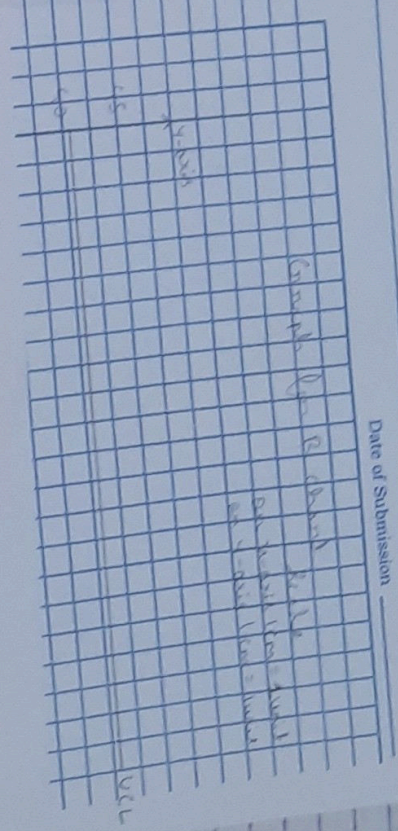
1. Fill in all the entries neatly and correctly immediately after receiving the answer book.
2. Write on both side of the page.
3. Students using unfair means will not be allowed to appear for the examination and his/her name will be reported to the Principal for necessary action and his/her name will be reported to his/her parent/guardian.
4. Bring your identity card.

[Handwritten mark]

Sample No	Observations	\bar{X}	R
1	21 31 31 25	29	18
2	30 48 19 41	36.5 27.5	15
3	35 21 20 35	28.5	17
4	39 22 24 29	30.75	23
5	23 25 46 24	30.75	24
6	26 52 30 28	36.5	25
7	33 15 40 29	29.25	25
8	25 30 20 19	23	11
9	28 30 31 31	32.25	10
10	35 37 33 32	36	7

$$\bar{X} = \frac{\sum X}{10} = \frac{303.75}{10} = 30.375$$

$$R = \frac{\sum R}{10} = \frac{179}{10} = 17.9$$



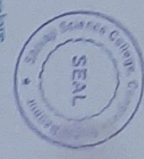
Date of Submission _____

Date : _____

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No. _____

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Dattatraya S. Bhat

STATISTICS PRACTICAL SHEET

Conclusion:-
 In X-chart the process is under control.
 In R-chart the process is under control.

10 ✓
 VCR Hours No. of observations $P_i = \frac{d_i}{n}$

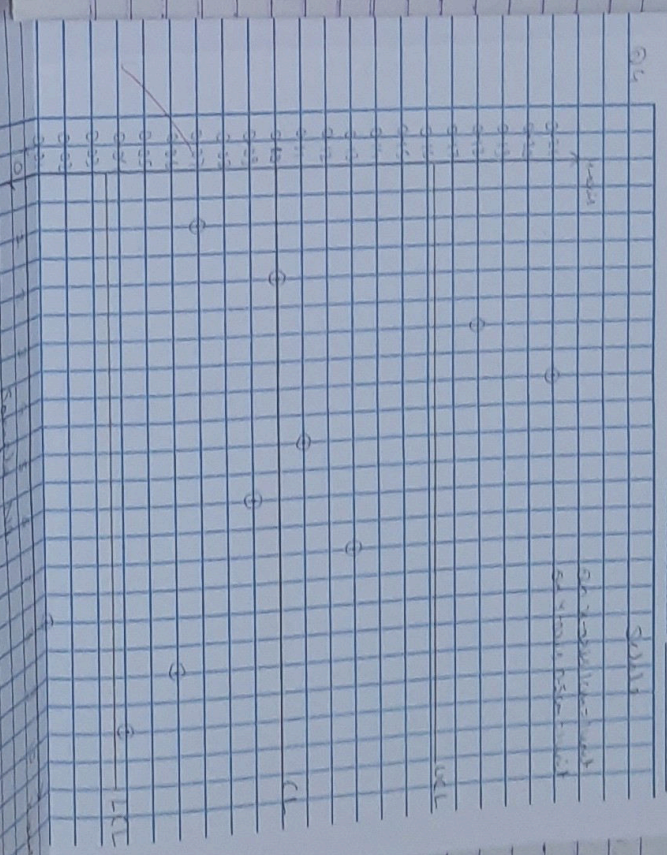
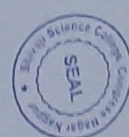
Sample No.	Sample Avg	NO. of observations	$P_i = \frac{d_i}{n}$
1	200	14	0.07
2	200	20	0.1
3	200	36	0.18
4	200	42	0.21
5	200	22	0.11
6	200	18	0.09
7	200	26	0.13
8	200	2	0.01
9	200	12	0.06
10	200	8	0.04

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STATISTICS PRACTICAL SHEET

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$$LCL = 0.037$$

Conclusion:-

One point is below the LCL and the process is out of control.

Q5

Given: $K = 10 \pm 29$, $n = 100$, $S_{di} = 120$

$$\bar{P} = \frac{1 \times S_{di}}{K \times n} = \frac{120}{100 \times 10} = 0.06$$

$$q = 1 - \bar{P} = 0.94$$

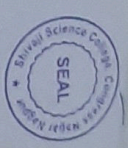
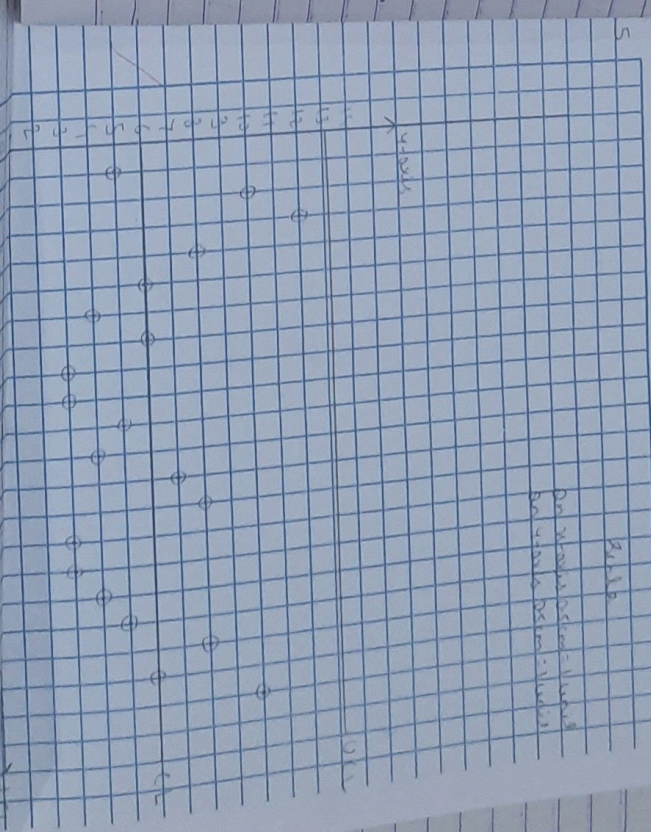
$$UCL = n\bar{P} + 3\sqrt{n\bar{P}q}$$

$$= 100 \times 0.06 + 3\sqrt{100 \times 0.06 \times 0.94}$$

$$= 6 + 3 \times 2.37$$

$$= 6 + 7.12$$

$$= 13.12$$



No. _____ Date: _____

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Roll No. _____

Don't forget to sign and date the sheet.

$$= n\bar{p} = 6$$

$$= n\bar{p} - 3\sqrt{n\bar{p}\bar{q}}$$

$$= 6 - 3\sqrt{100 \times 0.6 \times 0.4}$$

$$= 6 - 3 \times 2.37$$

$$= 6 - 7.12$$

$$= -1.12$$

control limit cannot be negative

$$\therefore LCL = 0$$

Conclusion:-

All points are lie within UCL and LCL Hence
the process is under control.

10