NUS/1267

Third Year B.E.(Prod.) Examination

WORK STUDY

Paper 3 P 2

[Max.Marks :80

SECTION A

1. a) What is productivity ? What is the relationship between standard of living and Productivity ? How the productivity of industry can be increased ? 8

   b) What is work study ? What is the contribution of F.W. Taylor and F.B. Gilbreth in the development of Work-Study ? 6

OR

2. a) Define work-study. What is the need of work study ? 5

   b) What is the importance of human factor in the adoptation of work study ? 4

   c) What is 'basic work content ? How the total time of job is made up ? 5

3. a) Define 'Method Study' What are its objectives ? Explain the procedure of Method Study. 8

   b) Draw the various process chart symbols and explain their meaning. 5

OR

4. a) Explain flow process chart-material type with suitable example. 6

   b) List out the various charts, diagrams and graphs used for Method Study. 3

   c) Which points should be considered while selecting a job for Method Study ? 4

5. a) Explain two handed process chart with an example. 5

   b) Explain the construction, uses and drawbacks of string diagram. 8

OR

6. a) Explain multiple-activity chart with example. 5

   b) Explain construction, uses and draw backs of cyclegraph and travel chart. 8

SECTION B

7. a) Define 'Work-Measurement' Explain the procedure of work measurement. 6

   b) List out various Work Measurement techniques 3

   c) What is the Meaning of qualified worker ? How the worker is selected for time-study ? 4

OR

8. a) Discuss the objectives of work-measurement. 6

   b) What is pre-determined time-standard ? What are its applications ? 7

9. a) An industrial job involves five operations and related data is given below. Assuming Rest and personal allowances as 10% and contingencies as 2% of the basic time. Find standard time for completing the job. 8

Operation Number	Observed Time (Min.)	Standard Rating (0 – 100)	Remarks if any
1	0.20	85	-
2	0.32	95	-
3	0.26	90	-
4	0.35	100	-
5	3.05	80	Observed time is for transporting 5 jobs

b) List out the equipments required for time study. 2

c) What are the applications of time study ? 4

OR

10. a) Explain the procedure of stop watch time study. 7

b) Define :-

i) Standard time.

ii) Basic time. 2

c) What are allowances ? What are different types of allowances ? Explain any one. 5

11. a) Why training is needed to personnel while introducing work study ? 6

b) What are incentives ? Explain following wage incentive plans.

i) Halsey plan.

ii) Roman plan 7

OR

12. a) Explain the steps involved in developing standard data. 7

b) What are the steps to be taken to increase the productivity ? 6

N-045 **S.N.P.- 898**

Third Year B. E. (Prod) Examination
WORK STUDY
Paper : 3 – P – 2
Section : A & B
Max. Marks : 80

SECTION – A

1. A) Good relations must be established before work-study is conducted. Explain. 7

   B) How productivity of material can be increased through saving at various stages of production. 7

OR

2. A) What do you mean by basic work content ? How ineffective time is added due to worker ? 7

   B) Why workers oppose the application of work study in industry ? 7

3. A) Name various process charts used in 'Method-Study' and explain any one of them in detail. 7

   B) Explain the following : 6

   i) Flow diagram

   ii) Travel chart

OR

4. A) 'Critical examination is the crux of method study'. Discuss. 7

   B) Discuss the factors to be considered while selecting the work for method – study. 6

5. A) What is SIMO chart ? Explain with an example. 7

   B) What is 'Memomotion' study ? State its application with example. 6

OR

6. A) What are 'Therbligs'? Define and draw following therbligs. 6

   i) Assembly
   ii) Inspect
   iii) Plan

   B) Define 'Micro-motion' study. Explain the steps in micro-motion study. 7

SECTION – B

7. A) Define 'Work-measurement.' Explain the various techniques of work-measurements. 7

B) What is pre-determined time-standard ? What are its applications ? 6

OR

8. A) Discuss the objective of work-measurement. 6

B) What do you mean by 'Standard data' ? State its application with suitable example. 7

9. A) Explain the steps in making stop-watch time study. 7

B) What are the reasons for breaking the jobs into elements in time-study? 7

OR

10. A) An industrial job involves three operations and related data is given below. Assuming rest and personnel allowances as 10 % and contingencies as 2 % of basic time. Find standard time for completing job. 8

Operation No.	Observed Time (min)	Standard rating (0-100)
1	0.32	85
2	0.35	95
3	2.10	80

B) What are applications of Time-study ? 6

11. A) What are the problems in increasing productivity through work study ? 6

B) What are incentives ? Explain following wage incentive plans. 7

i) Halsey plan

ii) Rowan plan

OR

12. A) Explain the steps involved in developing standard data. 7

B) What are the steps to be taken to increase the productivity.

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NVD / 1284

Third Year B. E. (Production Engg.) Examination
WORK STUDY
Paper 3 P2
Max. Marks : 80

SECTION – A

1. a) What is work study ? Explain its need and scope of applications. 6
   b) Define Productivity. Discuss the factors responsible for reducing Productivity. 7

OR

2. a) The attitude of the supervisor must be won before work study is conducted. Why ? 6
   b) What do you mean by basic work content ? How ineffective time is added due to workers ? 7

3. a) Discuss the factors to be considered while selecting the work for method study. 3
   b) Name the various process charts used in Method study and explain any one of them in detail. 5

OR

4. a) Define Method study. Explain in detail the various steps involved in systematic methods of improvement. 7
   b) Explain the following :-
   Flow diagram.
   Travel chart. 6

5. a) Discuss principles of motion economy as applied to human body. 5
   b) Define method study. Explain in detail the various steps involved in systematic methods of improvement. 6
   c) What is chronocyclegraph ? 3

OR

6. a) Explain the term templates and models with their advantages and disadvantages. 6
   b) What is memomotion study ? State its applications. 3
   c) What is SIMO chart ? Explain with an example. 5

SECTION – B

7. a) Define work Measurement. Explain is brief the procedure of work measurement. 5
   b) State the applications of standard data. 3
   c) 'Management is responsible for the stoppages and the breakdowns. This can be found our with the help of work measurement. Explain. 5

OR

8. a) What are the applications of work measurement ? 5
   b) Enlist the techniques of work measurement with short explanation. 8

9. a) What are the reason for breaking the job into elements in time study ? 5
   b) An industrial job involves three operations and the related data is given below. Assuming Rest and personal allowances as 10% and contingencies as 2% of the basis time find the standard time for completing the job.

Operation No.	Observed Time (min.)	Standard Rating (0-100)
1	0.32	85
2	0.35	95
3	2.10	80

   5
   c) What are the applications of time study ? 3

OR

10. a) Discuss the steps involved in the procedure of stop watch time-study. 6
    b) What is performance rating ? Explain various systems of rating. 7

11. a) What is work sampling and how it works in Industries ? 5
    b) What are the problems in increasing productivity through work study? 5
    c) What are incentives ? List out the objectives of a sound wage incentive plan. 4

OR

12. a) A work sampling study was conducted for 100 hours in the machine shop in order to estimate the standard time. The total number of observations recorded were 2500. No working activity could be noticed for 400 observations. The ratio between manual and machine elements was 2:1. Average rating factor was estimated as 1.20 and the total number of articles produced during the study period were
    Rest and personal allowances may be taken as 12% of the normal time. Find the standard time. 4
    b) Explain the steps involved in developing standard data. 4
    c) What steps can be taken to increase the productivity ? 3

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DVW – 1182
Faculty of Engineering & Technology
Third Year B.E.(Production Engg.) Examination
WORK STUDY
Paper : 3 P 2
Sections A & B
Maximum Marks :80

SECTION A

1. (a) What is 'Work study' ? Write in brief the basic procedure of work study. 7
   (b) How is the total time of a job made up ? 6

OR

2. (a) What is productivity ? What are the factors affecting productivity ? 7
   (b) How can the work content be reduced due to the process and the methods ? 6

3. Define the method study and discuss the following tools used for the purpose : 13
   (i) Operation Process Chart.
   (ii) Flow diagram
   (iii) Travel Chart
   (iv) String diagram

OR

4. (a) Explain the procedure of method study. 7
   (b) How do flow process chart symbols differ from those used for two handed process chart ? 6

5. (a) What is SIMO chart ? Explain with an example. 8
   (b) Distinguish between memomotion and micromotion study. 6

OR

6. (a) What are cyclegraphs and chronocyclegraphs ? 6
   (b) Show with the help of two-handed process chart, how productivity can be improved by resequencing the activities of certain operation. 8

SECTION B

7. (a) What is 'Work measurement' ? Explain its relationship with 'Method study'. 7
   (b) Discuss various application s of 'Work measurement'. 6

OR

8. (a) 'Management is responsible for the stoppages and the breakdowns.' This can be found out with the help of work measurement. Explain. 5

(b) Enlist the techniques of work measurement with short explanation. 8

9. Discuss the procedure for timing each element by stop watch in detail. 13

OR

10. (a) What is performance rating ? Why it is necessary ? Discuss various systems of rating. 8

(b) Why it is necessary to break down the job into elements ? 5

11. (a) Explain the steps involved in developing standard data. 5

(b) Define the term Work Sampling. What are its applications ? 5

(c) List out the objectives of a sound wage incentive plan. 4

OR

12. A work sampling study was conducted for 100 hrs.in the machine shop in order to estimate the standard time. The total number of observations recorded were 3000. Number of working activity could be noticed for 450 observations. The ratio between manual and machine elements was 2:1. Average rating factor was estimated as 1:15 and the total number of articles produced during the study period were 7,000. Rest and Personal allowances may be taken as 12% of the normal time. Find Standard time. 14

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STD-1109

Faculty of Engineering & Technology

Third Year B.E. (Production Engg.) Examination

WORK STUDY

Paper 3 P 2

Sections A & B

Maximum Marks – 80

SECTION A

1. (a) Define Work Study. What is the contribution of F.W. TAYLOR to work study ? 7

   (b) How work study is useful for Management, Labour Society and Industrial Productivity ? 7

OR

2. (a) Define Productivity. Discuss the factors responsible for reducing Productivity. 7

   (b) What are the problems likely to be encountered in implementation of work study ? How should they be dealt with ? 7

3. (a) Name the various process charts used in Method Study and explain any one of them in details. 6

   (b) Define Method Study. Explain in detail the various steps involved in systematic methods of improvement. 7

OR

4. (a) Define Process Charts. What are the symbols used to record different types of events ? 6

   (b) Prepare a outline process chart of making a Dovetail joint in a pattern making shop. 7

5. (a) Describe cyclograph and chronocyclograph and explain their use with a neat sketch. 6

   (b) List various principles of Motion Economy as applicable to the use of Human body. 7

OR

6. (a) What are the techniques of Micromotion study ? Give the list of various Micromotion study Equipment. 7

   (b) What is a string diagram ? Draw a string diagram of a work of your choice. 6

SECTION B

7. (a) Assuming that the total observed time for an operation of assembling an Electronic Switch is 1.00 minute. If the rating 120% find the normal time. If the allowance of 10% is allowed for the operation, determine the standard time. 5

   (b) Define Work Measurement and what are the fundamental concepts of work measurement. 8

OR

8. (a) What are the various systems in use of P.T.S. ? Explain one most popular amongst them. 9

(b) What do you mean by Qualified Worker ? 4

9. (a) Give brief accounts of all the main Rating systems. 7

(b) What is elemental breakdown in time study ? Give its advantages. 7

OR

10. (a) Discuss the various factors which are taken into consideration while selecting an operator for time study. 5

(b) Explain the following terms :-

Rating

Fatigue allowance

Standard time. 9

11. (a) Give the salient features of sampling procedure in work sampling. 7

(b) A work sampling study showed that 20% of a work, week of 48 hours was consumed by available delays. If each time a work sampling observation was made, the operator was rated and the average of such ratings was 110%. If 100 units were produced by the operator in that period, calculate the standard time. 6

OR

12. (a) What is work sampling and how it works in Industries ? 8

(b) Enumerate the uses and limitations of work sampling. 5

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GOV-894/VMT-7868
WORK STUDY

SECTION – A

1. (a) Increased productivity lead to higher standard of living. Justify. 5
   (b) Define Ineffective time. 2
   (c) Which are the factors reducing productivity ? 6

OR

2. (a) What is work study ? What is the contribution of F.W. Taylor to work study ? 7
   (b) Explain the procedure for work study ? What are the advantage of work study ? 6

3. (a) Define method study. What are the objectives of method study of the procedure for carrying out method study ? 8
   (b) Name the various process chart used in method study and explain one of them in detail. 5

OR

4. (a) Which factors are to be considered while selecting the work for method study ? 5
   (b) Explain the principle of motion economy as applied to Human body. 5
   (c) Explain material flow process chart with suitable example. 3

5. (a) Define multiple activity chart. Explain it with a suitable example. 5
   (b) Define and explain 'Simo-chart'. 4
   (c) Distinguish between memomotion and micromotion study. 4

OR

6. (a) Define and explain cycle-graph with neat sketch. 3
   (b) Explain the steps involved in the process of micromotion study. 5
   (c) Define and draw symbols of following therbligs :-
   (i) Unavoidable delay
   (ii) Transport loaded
   (iii) Plan
   (iv) Rest
   (v) Assemble
   (vi) Find 5

SECTION B

7. (a) In an eight-hour day it was found that the normal time was 400 minutes. Assuming that the remaining time is meant for rest and personal needs. Determine the standard time/article, if the normal time/article is 1.5 min. Also find the no. of articles produced/day. 5
   (b) Define allowances. Explain :
   Personal and Rest Allowance
   Special Allowance. 5
   (c) What do you mean by a Qualified worker ? 3

OR

8. (a) Define work measurement. What is the procedure for work measurement ? 6

(b) Assume you are the Supervisor. Work measurement is to be introduced into your department. How would you explain to your men the technique of work measurement and how it might effect them ? 7

9. (a) Describe the advantages and disadvantages of both snap-back and continuous method of using a stop watch. 6

(b) How standard time is calculated ? 3

(c) What is Rating in time study ? Why is it done ? 4

OR

10. (a) What are the techniques of work measurement ? Explain each of them briefly. 7

(b) What is the purpose of work measurement ? Explain the uses of work measurement. 6

11. (a) How the sample size is decided ? 3

(b) Define Standard Data. How is the standard data developed ? 6

(c) What are the limitations of work sampling ? 4

OR

12. (a) How activity sampling can be used to determine the efficiency of utilization of men and m/c in a machine shop ? How would you use their information ? 6

(b) Define incentives. What are the characteristics of a good incentive plan ? 4

(c) Explain the HALSEY wage incentive plan. 3

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VSH-674/MHR-5424
WORK STUDY

SECTION A

1. (a) "Work study is one of the most pertaining tool of investigation available to the Management.". Explain. 5
   (b) "Good relation must be established before work study is conducted". Comment. 6
   (c) What do you understand by productivity of materials ? 2

OR

2. (a) Describe Frank Gilbreth contribution to the development of work study. 6
   (b) Explain in brief concept of productivity. 7

3. (a) What is method study ?
   How will you determine the areas that need method study application in an industry ? 7
   (b) What is the difference between flow process chart and Two handed process chart ? Draw flow chart for the activity of cleaning the spark plug of a motorcycle. 6

OR

4. (a) Explain Two handed process chart with suitable example. 4
   (b) Explain the principles of motion economy as applied to Human body. 6
   (c) What are the different types of flow process chart ? 3

5. (a) Define Travel Chart ? Explain the procedure for preparing a Travel Chart. 6
   (b) What is chronocyclegraph ? 2
   (c) Define Therblig's ? How will you show the following therblig's:- 5
   (i) Assemble
   (ii) Rest
   (iii) Inspect
   (iv) Plan
   (v) Hold

OR

6. (a) In a manufacturing unit two handed process chart is prepared for 'clamping the job on m/c' which is as follows :

Left Hand Description	I.H. Symbol	R.H. Symbol	Right Hand Description
To W/P	→	D	Idle on m/c
Grasp W/P	O	D	Idle on m/c
To Machine	↙	D	Idle on m/c
Release W/P	O	D	Idle on m/c
Idle	D	O	Place W/P in position

Idle	D	O	Turu Handle to clamp
To m/c		D	Idle to m/c
Strait m/c	O	D	Idle to m/c
To m/c		D	Idle on m/c
Stop m/c	O	D	Idle on m/c
Turn Handle to unclamp	O	D	Idle on m/c
Push away job	O	D	Idle on m/c

Suggest an improved method for the activity based on data obtained from the above chart, so that the motion of both the hands 7

(b) What is Flow Diagram ? Illustrate it with a suitable example. 6

SECTION B

7. (a) Define work measurement. What are the various techniques used for work measurement ? Explain any one in detail. 7

(b) What is predetermined time standards ? What are its advantage and where is it used ? 6

OR

8. (a) What are the objective of work measurement ? 4

(b) Define Rating. Explain :
(i) Synthetic Rating.
(ii) Objective Rating. 5

(c) What are the uses of Standard Data ? 4

9. (a) What is time study ? Which equipments are used for carrying out time study ? 5

(b) What are the steps involved in making a time study ? 5

(c) Can the time study be carried out on any worker ? 3

OR

10. (a) What different allowances are provided to arrive at standard time ? 4

(b) Define rating. Why is it necessary ? Explain the various rating techniques in detail. 9

11. (a) What do you know by work sampling ? What are its applications ? 6

(b) Explain the following wage incentive plan :-
(i) ROWAN Plan
(ii) HALSEY Plan

OR

12. (a) Define 'Activity Sampling'. 2

(b) Define 'Standard data'. Also give its application. 5

(c) "Incentives are necessary for smooth and efficient running of a factory." Discuss. 6

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NUS/1278

Third Year B.E. (Production Engg.) Examination

METROLOGY AND QUALITY CONTROL

SECTION A

1. (a) What are fits ? Explain in brief the following types of fits. How they can be achieved ?
   (i) Selective fit
   (ii) Push fit
   (iii) Driving fit
   (iv) Forced fit
   (v) Shrinkage fit 10

   (b) A limit gauge is required to check the hole 50 H8. The length of the hole is 100 mm. Neglecting the guage tolerance and wear allowance, show the GO and NO GO limit gauges for checking hole as per IS : 919. Given : IT 8 for basic size 50 mm = 39 microns. 4

OR

2. (a) Why is it necessary to give a tolerance on an engineering dimension ? Give examples of various types of tolerances. 7

   (b) Explain what do you understand by 'an end standard' and 'a line standard'. Sketch and describe international prototype meter and state under which of the above categories this falls. Also discus its disadvantages. 7

3. (a) Explain the principles of pneumatic gauging by the 'back pressure' system. Why is it not used over entire range of pressure ? 7

   (b) What are the measures of an angle ? Describe and sketch the principles of clinometer. 6

OR

4. (a) Compare mechanical, comparator and optical comparator. Describe the working of mechanical optical comparator. 6

   What is 'best-size wire' ? How will you measure effective diameter of external thread using 'best-size wire ? 7

5. (a) How will you check small threads using 'Tool – Maker's Microscope'? Explain. 7

Explain the following in relation to surface texture.
Ra Value
Sampling length
Lay 6

OR

6. (a) Explain in detail the working of mechanical roughness instrument. 'Mecrin'. 6

Discuss about various errors in gear.
How will you check composite errors in a spur gear ? 7

SECTION B

7. (a) What do you understand by cost of quality and value of quality ? How to balance them ? 7

(b) State and explain the responsibilities of a Quality Manager. 6

OR

8. (a) Explain the steps in quality control programmes. What are the benefits of statistical quality control ? 6

(b) What is 'Process capability' ? Explain three possible relationships between process capability and specification limits of the dimension of the workpiece. 7

9. (a) What do you understand by "Statistical control of production processes" ? 6

(b) Number of defects (non – conformities) recorded for 10 lots containing different number of units are recorded below : 8

Lot	Unit	Non-Conformities
1	46	118
2	43	96
3	49	125
4	45	87
5	45	99
6	47	123
7	44	104
8	46	123
9	45	112
10	42	98

Construct appropriate control chart and comment about the process.

OR

10. (a) Sample of 5 were taken at regular intervals from a process. 10 samples in all being taken. The results were as follows :

Sample No	Measurement Per Sample (hundredths of one mm)				
1	747	748	747	749	748
2	748	749	750	748	749
3	749	748	750	748	749
4	749	749	750	750	751
5	749	749	750	750	751
6	749	750	751	749	750
7	750	750	751	751	750
8	751	750	750	750	752
9	751	751	752	751	751
10	751	752	752	753	751

Construct $\overline{X}$ and R charts and interpret the charts.
Given : For Sample Size 5, $A_2 = 0.577$.
$D_4 = 2.115$, $D_3 = 0$ 8

(b) Compare attribute charts and variable charts, used in SQC. 6

11 (a) What is operating characteristic (o.c.) curve ?
Discuss in detail the characteristics of o.c.curve. 8

(b) Explain multiple sampling planes. 5

OR

12. (a) Discuss the interest of the consumer and the producer in the selection of sampling plans. 7

Differentiate between single sampling plan and double sampling plan. 6

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SNP – 909/TWA-5836
METROLOGY AND QUALITY CONTROL

SECTION A

1. (a) State and explain the four grades of standards depending upon the importance of standard. 5

   (b) What is meant by the term "flatness" as applied to metrology? 2

Determine the tolerances on the hole and the shaft for a precision running fit designated by 50 H_7g_6. You may use the following aid for solving the problem or use IS 919 for convenience :-

(i) 50 mm lies between the range 30-50 mm.

(ii) $i = 0.45 \sqrt[3]{D} + 0.001\ D$ (microns)

(iii) Fundamental deviation for g shaft
g shaft = $-2.5\ D^{o-34}$

(iv) IT 6 = 10 i
IT 7 = 16 i

State the actual maximum and minimum sizes of the both hole and shaft and maximum and minimum clearances. 6

OR

2. (a) Calculate the following quantities :- 6
   (i) Wavelengths of the orange radiations of krypton 86 in an inch.
   (ii) Position of the supports from the end of a bar of 800 mm, considering the minimum central deflection.
   (iii) Same as (ii) but considering Airy points.

   (b) Give the detailed classification of plain gauges. Explain each briefly. 5

   (c) What are the necessary conditions for interference of light waves ? 2

3. (a) Describe the essential characteristics of comparator. 3

   (b) Distinguish between Comparator and Gauges. 3

   (c) Show by means of a sketch; the design of a sine bar, and state without quoting values, the features of sine bar which have tolerances for accuracy. 4

   (d) Give the design principle i.e. Taylor's principle of thread gauge design. 3

OR

4. (a) Describe with neat sketch the construction and working of a solex pneumatic comparator. 7

   (b) How the effective diameter of a screw thread is measured ? 6

5. (a) What are the different elements those required to check the accuracy of the Gear ? Explain the method of Lead and tooth thickness measurement. 7

(b) Explain with the help of neat sketches principle and construction of an Autocollimator (i.e. Injected graticule autocollimator). 7

OR

6. (a) Explain the concept "Flatness". How it is indicated ? 4

(b) What are the reasons for controlling surface texture ? 3

(c) Explain what is meant by the 'lay' of a machined surface, and with the simple diagrams show the direction of lay for each of the following operation :

(i) Facing at a capstan lathe;

(ii) Grinding a flat surface at a surface grinding machine,

(iii) Milling a flat surface using an inserted tooth face milling cutter. 7

SECTION B

7. (a) Explain the following terms in respect of quality :-

(a) Product Feature

(b) Customer

(c) Grade

(d) Need 6

(b) "Attainment of quality requires the performance of a wide variety of identifial task and function." Explain briefly. 8

OR

8. (a) Explain the following terms :-

(i) Cost of prevention

(ii) Cost of appraisal

(iii) Cost of failure 6

(b) What do you mean by the word "Quality" in present day context ? What are the quality characteristics ? 5

(c) Explain the objectives for 'Break through' and 'Control'. 3

9. (a) What features of statistics entrusted in statistical quality control ? 4

(b) Explain with neat sketches the various patterns of control charts with their expectable causes. 4

(c) Control charts for $\bar{x}$ and R are maintained on a certain dimension of a manufactured part, measured in inches. The subgroup size is 4. The values of $\bar{x}$ and R are computed for each subgroup. After 20 subgroups, $\sum \bar{x}$=41.340 and $\sum$ R = 0.320.

Compute the values of the 3 sigma limits for the $\bar{x}$ and R charts, and estimate the values of σ^1 on the assumptions that the process is in statistical control. 5

OR

10. (a) Explain the difference between Variable control charts and Attribute control charts. 6

Why a 'np' chart is not recommended when the subgroup size is variable? 2

In a factory producing spart plugs, the number rejected found in the inspection of 20 lots of 100 each is given :-

Lot No.	Number Rejected	Fraction Rejected	Lot No.	Number Rejected	Fraction Rejected
1	5	0-050	11	4	0-040
2	10	0-100	12	7	0-070
3	12	0-120	13	8	0-080
4	8	0-080	14	2	0-020
5	6	0-060	15	3	0-030
6	5	0-050	16	4	0-040
7	6	0-060	17	5	0-050
8	3	0-030	18	8	0-080
9	3	0-030	19	6	0-060
10	5	0-050	20	10	0-100

Total No. of Rejects = 120

Construct appropriate control charts and state whether the process is in control ? 5

11. (a) How might a company protect itself against being supplied with material of inferior quality ? Discuss the concept of 'Consumer's risk' and 'Producer's risk', in connection with acceptance sampling scheme.

State the objectives of acceptance sampling.

What are the four types of acceptance control methods ? 7

(b) Explain acceptance/rejection and acceptance/rectification plans. 6

OR

12. (a) Explain Single sampling, Double sampling, Multiple sampling and Sequential sampling plan. 10

(b) Define AQL, LTPD, AOQL. 3

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NVD/1295

METROLOGY AND QUALITY CONTROL

SECTION A

1.	a)	Define 'metre' as of today. What are advantages of optical standard over material standard ?	6
	b)	Give classification of limit gauges and explain any two with the help of diagrams.	9
		OR	
2.	a)	Explain briefly the difference between the interchangeable manufacture and selective assembly.	5
	b)	Why is it necessary to give a tolerance on an engineering dimension ? Give examples of :- i) unilateral tolerance, ii) bilateral equal tolerance, iii) bilateral unequal tolerance,	4
	c)	Discuss the salient features of line measuring and measuring instruments.	5
3.	a)	Describe any of the optical comparators. Also comment on the magnification obtained in it.	7
	b)	Explain the construction, working and uses of the universal bevel vernier protractor.	6
		OR	
4.	a)	With a neat diagram illustrate the principle of a dial indicator, show clearly the method adopted to obtain magnification of the plunger movement.	7
	b)	Name the different elements required to be measured checked in order to determine the accuracy of screw threads. Also sketch and explain limit of screw threads. Also sketch and explain limit gauges for internal threads.	6
5	a)	Explain briefly how a precision level can be used to determine flatness and straightness of machine beds.	6
	b)	Name and define the various elements of a spur gear which are checked for correct functioning of a gear. Explain the method for checking pitch of a spur gear.	7
		OR	
6.	a)	Explain the base tangent method of gear tooth thickness measurement.	5
	b)	Discuss the adverse effects of poor surface finish. Also, explain the following terms related to surface texture measurement. (i) Lay (ii) Ra (iii) Sampling length.	8

SECTION B

7. a) Explain the term "optimum quality of design" with help of a graph. 6

   b) What do you mean by the term "field complaints ? State the significance of field complaints in quality assurance function. 7

OR

8. a) What is "Quality mindness"? How does it help in improving the quality of the product ? 7

   b) What are the three main elements of quality function ? Explain. 6

9. Compare X chart with R chart. Discuss the circumstances in which either of the two or a combination of these will be used for the purpose of control. The following are the $\overline{X}$ and R values of 4 subgroups of readings :- 3+3+8

   X = 10.2, 12.1, 10.8 and 10.9

   R = 1.1, 1.3, 0.9 and 0.8

   The specification limits for the components are 10.7±0.2.

   Establish the control limits for $\overline{X}$ and R charts. Will the product able to meet its specification ?

   Given : A_2 (factor for $\overline{X}$ chart) = 0.58

   D_4 (factor for R chart) = 2.11

   D_5 (factor for R chart) = 0.00

OR

10. a) Compare attribute charts and variable charts of quality control. 7

    b) What is process capability ? The design specifications for a component are 100 ± 0.5 mm. Whereas the process report shows that process average is 99.9 mm and standard deviation is 0.18. Do these figures call for any action by any one ? What action is necessary and by whom ? 7

11. a) Compare random sampling and stratified sampling. 6

    b) What is meant by O. C. curve ? Sketch neatly the ideal and actual O. C. curve. How O. C. curves are useful in selecting acceptance level ? 7

OR

12. a) What do you mean by Acceptance sampling ? How does it help in Quality control ? 5

    b) Explain Single sampling and Double Sampling plan. 8

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DVW/1193

Third Year B. E. (Prod.) Examination

METROLOGY AND QUALITY CONTROL

SECTION A

1. a) What do you understand by Line and End measurement ? Discuss their relative characteristics. 6

   b) Determine the diamensions and tolerances of shaft and hole having size of 30 H_7 h_8. Also determine the allowances (i.e. minimum and maximum clearances).
   Use may use :
   1) 30 mm lies in 18-30 step,
   2) $i = 0.45 \sqrt[3]{D} + 0.001 D$.
   3) IT.7 = 161 and IT 8 = 25i. 8

OR

2. a) What is gauge maker tolerance and were tolerance ? How it is applied in gauge design ? 4

   b) What are the advantages and limitations of limit gauges ? 3

   c) Explain with neat sketches the basic hole system and unilateral system. 7

3. a) A 200 mm size bar is to be set to an angle of 32^0 5' 6". Find the length of gauge blocks required from 87 piece set. 6

   b) Give the fundamental requirements which every comparator must fulfil. 7

OR

4. a) Give importance of front reflecting mirror in case of optical comparator. How magnification is achieved in optical comparator ? 6

   b) Explain 'Principle of Vernier' and use of Vernier height gauge. 7

5. a) What do you mean by 'Master Gear'? Give the different elements to be checked for accuracy of a gear. (Spur Gear). Explain in short any three. 7

   b) What are the components of surface Texture ? What is the reason for controlling surface texture ? 6

6. a) Explain 'Tomlinson' surface meter. 7

   b) Enumerate the advanatages and limitations of dial indicator. 6

SECTION B

7. a) The Quality cost is determined as internal failure cost and external failure cost. Explain. 6

   b) Attainment of quality requires the performance of wide variety of identifiable task and functions. Explain. 8

OR

8. a) What do you understand by 'Quality audit and how is it conducted in an industrial organization ? 8

b) What do you mean by the word 'Quality' in present day context ? What are the Quality characteristics ? 6

9. a) Why statistics comes to frey in quality control ? 5

b) Data were collected for a large box of bolts containing about 10% non-confirming items. Plot 'np' chart based on the data given below. 8

Sub group No.	Number Inspected	Number Non-conforming	Sub group No.	Number Inspected	Number Non-confirming
1	200	28	13	200	20
2	200	20	14	200	23
3	200	24	15	200	28
4	200	19	16	200	28
5	200	17	17	200	15
6	200	25	18	200	23
7	200	25	19	200	17
8	200	22	20	200	22
			21	200	25
9.	200	22	22	200	20
10.	200	16	23	200	18
11.	200	22	24	200	14
12.	200	18	25	200	13

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MNL-820/ALL-2772
METROLOGY AND QUALITY CONTROL

SECTION-A

1. (a) Discuss the characteristics of line standards and end standards. 6
   (b) What are limit gauges ? Sketch and explain any two types of limit gauges. 8

OR

2. (a) State Taylor's principle in design of limit gauges.
   What are the advantages of using progressive type gauge versus double ended plug gauge for checking holes ? 8
   Explain clearly the following types of fits :-
   Selective fit
   Driving fit
   Forced fit
   Shrinkage fit. 6
3. (a) What are possible errors in an external screw threads ?
   Sketch and explain limit gauges for external threads. 8
   (b) Clearly distinguish between limit gauges and comparators. 5

OR

4. (a) What are advantages of optical comparator over mechanical comparators ? Sketch and explain any one type of optical comparator. 7
   (b) Which conditions must exist if a sine bar is to be accurate ?
   How sine bar is used for large components ? 6
5. (a) Define tooth thickness in case of a simple spur gear.
   How it is measured using vernier gear tooth caliper ?
   What is the expected accuracy of such a vernier ? 7
   (b) Discuss the applications of Tool Maker's microscope. 6

OR

6. (a) Sketch and explain the working of Tomblinson surface meter. 7
   (b) Define the term "Squareness" of a try-square.
   Describe in brief the reversal method used to test the squareness error of an engineer's square. 6

SECTION-B

7. (a) Define the term quality. Also differentiate between quality of design and quality of conformance. 6
   Explain the term "Quality Assurance Function".
   What is "Quality mindness" ? How does it help in improving the quality of the product ? 7

OR

8. (a) What do you understand by Vendor Quality Rating ? Explain the need of V.Q.R. 5

(b) Explain the following as applied to the quality control :-

(i) Appraisal Cost

(ii) Prevention Cost

(iii) Failure Cost

(iv) Optimum Cost. 8

9. (a) Distinguish between variable data and attribute data with appropriate examples. 6

Following table refers to the average number of outlet leaks per radiator for 10 lots of 100 radiator each :-

Lot No.	1	2	3	4	5	6	7	8	9	10
Number of leaks	15	17	12	16	14	5	14	11	9	10

(c) Establish u chart for the future production. 8

OR

10. What is "Process capability" ? Plot $\overline{X}$ and R charts if $\sum \overline{X} = 357.50$, $\sum R = 9.90$, Number of subgroups = 20.

It is given that $A_2 = 0.18$, $D_3 = 0.41$, $D_4 = 1.59$ and $d_2 = 3.735$.

Also find the process capability and comment on the process. 14

11. (a) State the advantages and limitations of sampling inspection as compared to 100% inspection. 6

(b) Explain single sampling plan and double sampling plan with respect to their respective acceptance criteria. 7

OR

12. (a) What is meant by O.C. curve ? Sketch neatly the ideal and actual O.C. curve. How O.C. curves are useful in selecting acceptance level ? 7

Discuss the interests of the consumer and the producer in the selection of sampling plans. 6

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ICA/772

METROLOGY AND QUALITY CONTROL

SECTION A

1.	a)	Define present day meter in optical term.	2
	b)	Clearly distinguish between Line Standard and End Standard.	4
	c)	What do you understand by term Tolerance and allowance ?	3
	d)	Give the advantages of using wave-length standard to define primary standard.	4
		OR	
2.	a)	What do you understand by limit gauges ? State Taylor's principle for designing limit gauges.	4
	b)	Design workshop type progressive type GO and NO GO plug gauge suitable for 20H7 You can use either IS 919 or the following information. i) 20 mm lies in diameter steps 18-30 mm, ii) Fundamental Tolerance unit in micron, $i = 0.45 \sqrt[3]{D} + 0.001 D.$	10
3.	a)	What is comparator ? Give some design considerations for comparator.	3
	b)	Explain the principle of optical comparator, give its advantages and disadvantages.	4
	c)	State the essential requirements for accuracy in construction of sine bar. Why it is that the use of sin bar is not recommended for angles larger than 45^0 with the reference plane ?	6
		OR	
4.	a)	What is meant by drunken thread ? What difficulties does it present in finding the pitch of the thread ?	3
	b)	Name the different elements required to be measure in order to determine the accuracy of screw thread.	3
	c)	Give the methods of measuring the effective diameter of a screw thread. Explain the three wire method of ascertaining the effective diameter of a screw thread.	7
5.	a)	Name and define the various elements of a spur gear which are checked for the correct functioning of a gear.	7
	b)	Explain briefly each of the following terms showing its importance in measurement of surface texture. i) lay, ii) Ra, iii) Primary texture, iv) Secondary texture.	6

OR

6. a) Explain the use of dial gauge and varnier height gauge. 6
   b) Describe with sketch the working principle and application of auto callimator. 7

SECTION B

7. a) What is the meaning of quality of conformance ? Explain factors which influence the quality of conformance. 4
   b) Define the term 'quality control' and explain its advantages over inspection technique. 4
   c) "Higher quality of design usually cost more and higher quality of conformance usually cost less". Comment. 6

OR

8. a) How quality mindedness can be created in the organization ? 4
   b) What is quality assurance ? What are the steps involved in it ? 5
   c) "Inspection planning is a part of planning for quality". Comment. 4

9. a) Describe briefly the 'Run Sum test'. 3
   b) What do you meant by process capability ? How will you determine the same ? 6

A sub group of 5 items each are taken from a manufacturing process at a regular interval. A certain quality characteristics is measured and $\bar{x}$ and R values computed. After 25 sub-groups it is found that

$$\sum \bar{x} = 357.50 \text{ and } \sum R = 8.80$$

If the specification limits are 14.4 ± 0.40 and if the process is in statistical control, what conclusion can you draw about the ability of the process to produce items within specification ? 5

OR

10. a) What do you understand by "Statistical control of production process" ? 4
    b) What are the advantages of use of statistical methods in quality control ?
    c) What is meant by natural tolerance of the process ? 3

11. a) State and explain advantages of limitations of acceptance sampling over 100% inspection. 4
    b) Explain the OC curve with reference to sampling inspection and the meaning of the terms –
       i) Producers Risk,
       ii) Consumer's Risk 9

OR

12. a) Differenciate between Acceptance/Rejection and Acceptance/Rectification schemes. 4

b) Explain the following terms (any two) -
AQL,
ii) AOQL,
iii) LTPD. 6

c) What are the advantages and disadvantages of double sampling plan ? 3

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STD-1122/TMG-7628
METROLOGY AND QUALITY CONTROL

SECTION A

1. (a) Enlist the advantages of wavelength standard. Define 'Meter' as of today. 3

   (b) Explain with neat sketches various types of limit gauges and their applications. 7

   (c) Define the following terms :-
   (i) Limits
   (ii) Fits
   (iii) Tolerances
   (iv) Allowance.

OR

2. (a) Give the meaning of following specifications of limit gauges :-
   (i) 30 H 7
   (ii) 40 d 5. 4

   (b) Explain the concept of 'Interchangeability' and 'Selective Assembly'. 5

   (c) What are the characteristics of line standards and end standards ? 5

3. (a) How comparator differs from limit gauge ?
   Explain with a neat sketch the working of Pneumatic comparator. 5

   A 100 mm sine bar is to be set at 22^0. Determine the slip gauges needed from 87 piece set. 4

   Explain with neat sketch any two types of limit gauges for screw threads. 4

OR

4. (a) How mechanical magnification is obtained in plunger type dial indicator ? Give various applications of dial indicator with the help of sketches. 6

   (b) Explain with a neat sketch the working of optical comparator. 4

   (c) Enumerate various instruments used for angular measurements with their expected accuracies. 3

5. (a) What are the possible errors in a spur gear ?
   Explain the working of 'Parkinson Gear tester'. 7

   (b) Explain the basic working principle of autocolimeter.
   Give its applications with the help of sketches. 6

OR

6. (a) In the measurement of surface roughness height of 20 successive peaks and troughs were measured from a datum and were 35, 25, 40, 22, 35, 18, 42, 25, 35, 22, 36, 18, 42, 22, 32, 21, 37, 18, 35, 20 microns. If measurements were obtained over a length of 20 mm. Determine the CLA and RMS values of the rough surface. 4

(b) Explain 'Tool Maker's microscope'. Give its uses and expected accuracy. 5

(c) How will you measure thickness of gear tooth using Vernier gear tooth caliper ? 4

SECTION B

7. (a) Define 'Quality'. Discuss the factors controlling quality of design. 5

(b) What is quality control ? State its objectives. 3

(d) What is quality mindedness ? How does it help in improving quality of product ? 6

OR

8. (a) What do you mean by quality cost ? Describe various categories of quality costs. 7

(b) Discuss the steps involved in the quality control process. 7

9. (a) Control charts for $\overline{X}$ and R are maintained on the tensile strength in N of a certain yarn. The subgroup size is 5. The values of $\overline{X}$ and $\overline{R}$ are computed for each subgroup. After 25 subgroups $\sum \overline{X}$ 518.8, $\sum$ R = 120.

(i) Compute the values of 30 limits for $\overline{X}$ and R charts. From table :
$A_2 = 0.58$
$D_2 = 0$
$D_4 = 2.11$.

(ii) How will you decide whether the process is "in control" or "out of control" ?

(iii) If a point representing certain subgroup in a control chart goes outside the control limits, what action should be taken ? 9

(b) Being a 'Quality control person' how will you make choice between X, R, P and C charts ? 4

OR

10. The following are the results of daily inspection of a variance tube. Compute the value of fraction defective for each day inspection and plot the control chart. Find revised control limits and check these points and replot. Also comment on process capability :- 13

May 1996	Lot size 'n'	Number of defectives 'ϕ'
3	1024	30
5	2056	86
6	16835	108
7	16069	59
12	7369	29
13	8738	10
14	1220	112
17	16242	76
18	15145	8
24	5845	8
25	13582	154

11. (a) Define 'Acceptance sampling'.
Also distinguish between randon sampling and stratified sampling. 5

(b) In a single sampling plan, n = 10 and C = 3, the lot size is large in comparison to the sample size.
(i) Plot the O.C. curve for sampling plan.
(ii) Find the probabilities of acceptance of lots 0.5% and 6% defectives. 8

OR

12. (a) Discus the principles of acceptance sampling. 5
(b) Give complete analysis of Double sampling plan with suitable example. 8

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PTV/869
AUTOMATIC CONTROL

SECTION A

1. (a) Obtain the transfer function of the mechanical system shown in fig.1. 6

Obtain the transfer function y(s)/x (s) of the signal flow graph shown in fig.2. 7

2. (a) A thermometer is dipped in a vessel continuing liquid at a temp of θ^I (t). The thermometer has a thermal capacitance for storing heat as C and a thermal resistance to limit heat flow as R. If the temperature indicated by the thermometer is θ_o(t), obtain the transfer function of the system. 6

Obtain the transfer function for the system shown in fig.3 by using block diagram reduction method. 7

3. (a) What are pneumatic relays ? Explain bleed type and non – bleed type of pneumatic relays with the help of suitable diagrams. 8

(b) Draw and explain the block diagram of automatic control system. 5

OR

4. (a) Explain the working of hydraulic servomotor with the help of suitable diagram. Derive the transfer function for it. 7

5. (a) The closed loop transfer function is given by.

$$\frac{c(s)}{R(s)} = \frac{K}{s^2 + a\,k\,s + k}$$

Determine the value of 'K' and 'a' so that the maximum overshoot in unit step response is 50% and the peak time is 5 seconds. 7

(b) Certain measurements were conducted on a servomechanism which show the system response as
$c(t) = 1 + 0.2\ e^{-60t} - 12\ e^{-10t}$. when subjected to a unit step input.

(i) Find the expression for closed-loop transfer function.

(ii) Obtain the undamped natural frequency and damping ratio of the system. 7

OR

6. (a) Figure, 4 (a) shows a mechanical vibratory system. When 12 N of force is applied to the system, the mass oscillates as shown in fig. 4(b). Determine values of M, F and K for the system from response curve.

Explain the time domain specification with the help of suitable diagrams. 5

SECTION B

7. (a) Explain the stability concept with reference to the control system. 5

(b) For the unity feedback system,

$G(s) = \frac{K}{s(s+2)\ (s+1)}$, plot the root locus. 7

OR

8. (a) For a system G(s) H(s) $\frac{K(1+s)}{S^3}$, Find range of K for system to be stable. 5

(b) Sketch the root locus of the unit feedback system with open loop transfer function $G(s)\frac{K(s+2)}{(s+1)^2}$ 8

9. (a) What is frequency response ?
Where is it applicable ? Discuss its advantages. 5

(b) What are the drawbacks of direct polar plots ?
How are they overcomed ? Sketch the polar
plot for the transfer function G (s) = $\frac{10}{s(s+1)}$ 8

OR

10. Sketch the Bode plot for a unity feedback system characterized by the loop transfer function. 13

$$G(s) = \frac{K(1 + 0.2\ jw)\ (1 + 0.025\ jw)}{(jw)^3(1+0.001jw)(1+0.005jw)}$$

11. (a) Discuss the procedure of compensation using Bode plot. 5

Derive the transfer function for electrical lag compensator
and explain the effects of lag compensation. 8

OR

12. (a) A unit feedback system has open loop transfer function.

$$G_f(s) = \frac{K}{s^2(1+0.2s)}$$

Design a Load compensator to meet the following specifications.
Acceleration error constant $K_2 = 10$ phase margin = 35^0. 14

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NVD/1293
AUTOMATIC CONTROL

SECTION A

1. (a) Why analogous system are important in control engineering ? Find an analogous mechanical system for an electrical system shown in fig.1, based on force voltage analogy. 7

Distinguish between following THREE types of system :
Linear and non linear
Time variant and Time invariant

OR

2. (a) Find out the transfer function for the control system shown in fig.2 using block diagram reduction method. 8

(b) Find the gain x_2/x_1, for the signal flow graph shown in fig.3. 6

3. Explain how PID control can be obtained with the help of a pneumatic control action. Give its schematic diagram and derive its transfer function. 13

OR

4. (a) Explain the working of pneumatic proportional plus derivative controller with the help of a neat sketch and derive transfer function for it. 9

(b) Enlist the basic control actions and explain any one of them. 4

5. (a) Define steady state error and error constants of control systems. Deduce the error constant for type '0' and type '1' systems. 6

Fig.4 shows a position control system with velocity feedback. Find the time respose specification, when the system is subjected to unit step input. 7

OR

6. (a) The open loop transfer function of a unity feedback system is,

$$G(s) = \frac{k}{s(s+3)}$$

The specifications of a step input respose are as follows.
Peak time = 0.8 sec.
Percentage overshoot = 7%

(i) Whether both specifications can be met simultaneously by a single value of K ?

(ii) If not, determine the compromise value of K so that the specified values of peak time and percentage overshoot are relaxed by same percentage. 10

(b) What do you understand by absolute stability, relative stability and steady state error ? 3

SECTION B

7. Open loop transfer function of a closed loop control system is given by

$$G(s)\,H(s) = \frac{K}{(s+3)\ (s+5)\ (s+1)}$$

Draw root locus for this control system and also out value of K
Which will make system unstable.
Which will make the system critically damped. 13

8. (a) Draw root locus of the control system having open loop transfer function 7

$$G(s)\ H(s) = \frac{K\,(s+4)}{S\,(s+2)}$$

(b) The characteristic equation of a control system is given by

$$s^4 + 6s^3 + 11s^2 + 6s + k = 0$$

what restrictions must be placed upon the parameter k in order to insure that the system is stable ? 6

9. Draw Bode plot for the control system having open loop transfer function

$$G(s)\ H(s) = \frac{s20\ (s+2)}{s\,(s+1)\ (s^2-8s+64)}$$

also find out phase margin, gain margin, phase cross over frequency and gain cross over frequency. 14

OR

10. (a) Differentiate polar plot and bode plot. 5

(b) Obtain polar plot of the following transfer function. 5

$$G(s) = \frac{e^{gL}}{1+sT}$$

(c) Explain the terms resonance frequency and resonance peak. 4

11. (a) Derive transfer function for electrical lead network. 6

(b) Explain the procedure for designing a lead compensator by root locus method. 7

OR

12. The frequency transfer function of a second order control system is

$$G(jw) = \frac{k}{jw\ (jw+1)}$$

Design a feedback control system which would satisfy the following frequency domain specifications phase margin greater than 40^0

$K \geq 12\ sec^{-1}$ 13

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