Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (TT)(N)/APM(N)/SEM-5/TT-504A/2012-13

2012
STATISTICAL QUALITY CONTROL

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

i) D3 in statistical process control stands for

a) $1 + \frac{3d_3}{d_2\sqrt{n}}$ b) $1 + \frac{3d_2}{d_3\sqrt{n}}$

c) $1 - \frac{3d_3}{d_2\sqrt{n}}$ d) none of these.

ii) Matrix diagram relates to

a) voice of customer against the capabilities of companies to meet the customer's need

b) a creative tool used to organise a lot of qualitative data

c) establishing relationships between & among various causes.

iii) 99·73% of the population values fall between the limits

a) $\mu \pm 2\sigma$ b) $\mu \pm 3\sigma$

c) $\mu \pm 1 \cdot 96\sigma$ d) $\mu \pm \sigma$.

iv) *t*-test is used for

a) testing the compatibility of observed and expected frequency

b) testing the difference between two variances

c) testing the difference between two sample means

d) testing simple variance.

v) Which of the following is not a component of quality cost ?

a) Maintenance cost b) Prevention cost

c) Appraisal cost d) Failure cost.

vi) ANOVA is conducted to test the significance of difference among

a) two means

b) more than two means

c) two variances

d) more than two variances.

vii) ISO 9000 is often referred to as

a) Enterprise standard

b) Plant standard

c) Certification standard

d) Quality standard.

viii) Rank correlation is used to find

a) degree of association between two objectively assessed variables

b) degree of association between two means

c) degree of association between subjectively assessed variables

d) none of these.

ix) The underlying probability distribution used in obtaining n and c values in single sampling plan is

a) normal b) binomial

c) Poisson d) none of these.

x) Best measure of dispersion is given by

a) standard deviation

b) mean deviation

c) range

d) coefficient of variation.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Define quality and state its different approaches.

3. a) What do you mean by degrees of freedom ?

b) In what context, is chi-square test used ?

c) What do you mean by standard error ? 2 + 1 + 2

4. If 2% of the cones produced by an autoconer are defectives, determine the probability that out of 10 cones chosen at random less than two cones will be defectives.

5. Average number of monthly breakdowns of an autoleveller in a drawframe machine is two. Determine the probability that in a given month, the autoleveller will function without any breakdown.

6. Write a short note on CUSUM & EWMA chart. $2\frac{1}{2} + 2\frac{1}{2}$

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Enumerate the procedure of acquiring ISO 9000 in detail.

   b) How does ISO 9000 differ from ISO 9001 ?

   c) What are the benefits accrued from ISO 9000 certifications ?

   d) What are the essential objectives of quality function deployment (QFD) ?

   e) Mention various strategic steps to employ it in case of a product line. $7 + 2 + 2 + 2 + 2$

8. a) On the basis of 5 quality tests 200 garments were categorised into two groups, premium 30% & normal 70%. In first quality testing, 40 garments from the first group & 80 garments from the second group had performed successfully. On the basis of these results, can one conclude that the first quality testing is no good at discriminating quality of garments being examined here?

   b) Neps in a card web are estimated by placing over web template with 34 round holes, each one square inch in area, and counting the proportion of holes that are free from neps and the number that contain one or more neps. If 20 holes are free from neps, what is the estimate of mean number of neps per 100 sq. inch of card web ?

   c) The average number of complaints that a day clear establishment receives per day is 3.3. Find the probability that it will receive only 2 complaints on a given day. 6 + 6 + 3

9. a) If on an average, 13% of the laps produced by a blow room line are defective, calculate the probability that more than 15% of a random sample of 400 laps will be defectives.

b) An experiment is performed in microscope instrument to determine whether the average denier of one kind of polyester staple fibres exceeds that of another kind by 0·5 denier. If 60 tests on first kind of fibre had an average denier of 1·62 with standard deviation of 0·06 and 40 tests on seemed kind of fibre had an average denier of 1·12 with a standard deviation of 0·07, test whether the difference between the average denier of two kinds of fibres really exceed by 0.5 denier at 5% level of confidence.

c) If the samples are independent, calculate the probability that two successive points will fall between the same warning and action limits. 5 + 6 + 4

10. a) The number of neps in 20 tests each of 1000 m yarn were

55, 42, 36, 45, 41, 43, 43, 43, 29, 39, 35, 41, 32, 40, 46, 28, 54, 45, 47 and 30.

Calculate the warning and action limits for a chart for the number of neps/100 m of yarn.

b) The following table shows the diameters (in arbitrary units) of a certain kind of cotton seed grown in four different locations :

Locations	Diameter of cotton seed											
I	8	6	6	7	8	7	5	6	7	8		
II	6	4	4	6	7	5	6	6	4	7		
III	7	4	4	7	7	5	5	3	5	5		
IV	8	4	7	9	5	8	6	5	4	7		

Carry out an analysis of variance to determine whether or not the seed diameter depends on location. If it does, state which locations are significantly different.

c) The standard deviation of a 30 tex yarn is known to be 1 tex. What size of sample is necessary in order that the warning limit is 2% of the mean ? 5 + 6 + 4

11. a) The data below relate the thickness loss during calendering of a viscose needle punch fabric and the load on calender bowl :

Load (x) : (in ton)	0·5	1·0	1·5	2·0	2·5	3·0
Thickness loss (y) : (%)	4	13	14	20	24	33

Fit an equation of the form $y = \beta x$ to this data. Calculate 95% confidence limits for β and for the thickness loss when the load = 2·3 tons.

b) Two people were asked to rank eight sweaters in order of attractiveness. Their rankings are given below :

Sweater	A	B	C	D	E	F	G	H
Judge 1	5	1	7	2	4	8	3	6
Judge 2	5	1	6	4	3	8	2	7

Calculate the rank correlation coefficient and test whether the two judges were in significant agreement.

9 + 6

12. Write short notes on the following : 3×5

a) Ishikawa diagram

b) Producer's risk and consumer's risk

c) Control limits, specification limits and natural tolerance limits.