Roll No

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B.E (Full Time) DEGREE ARREAR EXAMINATIONS, April – May 2011

INDUSTRIAL ENGINEERING

FIFTH SEMESTER **(Regulation 2008)**

IE 9303 STATISTICAL QUALITY CONTROL

Time: 3 Hours Max.Marks: 100

Answer all questions

Use of statistical tables permitted

PART – A (10 x 2 = 20 marks

1. What is the meaning of quality?
2. Differentiate between quality and reliability.
3. What is process variation?
4. How variable control charts are interpreated?
5. What is a multi-vari chart?
6. When individual measurements control charts are used?
7. What is AOQL?
8. How a double sampling plan is operated?
9. Define linear measurement. Give two or three examples of linear measuring instruments.
10. State the major advantages of NDT.

PART – B (5 x 16 = 80 marks)

11. Samples of size n= 6 items are taken from a manufacturing process at regular intervals. After 50 samples, $\sum \overline{X}$ = 1000 and $\sum$ S = 75. The quality characteristic is normally distributed.
    a) Compute control limits for $\overline{X}$ and S charts.
    b) If all sample means fall between the control limits, compute the natural tolerance limits.
    c) If the specification limits are 19 ± 4.0, determine whether the process meets the specification.
    d) If the item exceeds the USL, it can be reworked and if it falls below LSL, it must be scrapped, what percent of scrap and rework is produced?
    e) If the process were centered at μ = 19.0, what would be the effect on percent scrap and rework.

12. a) The net weight (in kgs) of a dry bleach product is to be monitored by X and R charts using a sample size of n = 5. Data on 15 samples are as follows.

Sample No.	X_1	X_2	X_3	X_4	X_5
1.	15.8	16.3	16.2	16.1	16.6
2.	16.3	15.9	15.9	16.2	16.4
3.	16.1	16.2	16.5	16.4	16.3
4.	16.3	16.2	15.9	16.4	16.2
5.	16.1	16.1	16.4	16.5	16.0
6.	16.1	15.8	16.7	16.6	16.4
7.	16.1	16.3	16.5	16.1	16.5
8.	16.2	16.1	16.2	16.1	16.3
9.	16.3	16.2	16.4	16.3	16.5
10.	16.6	16.3	16.4	16.1	16.5
11.	16.2	16.4	15.9	16.3	16.4
12.	15.9	16.6	16.7	16.2	16.5
13	16.4	16.1	16.6	16.4	16.1
14.	16.5	16.3	16.2	16.3	16.4
15.	16.4	16.1	16.3	16.2	16.2

i) Set up $\overline{X}$ and R charts and comment on the process.

ii) If the specification is 16.2 ± 0.5, evaluate the process capability by computing the capability indexes.

iii) What fraction of product is likely to be below the lower specification limit of 15.7 kgs.

(OR)

b i) Explain economics of quality of design and quality of conformance.

ii) Explain the quality costs in detail.

13 a i) What is a demerits per unit control chart? Explain its construction and use.

ii) A C-chart is used to monitor the surface defects on sheets of photographic film. The chart presently is set up based on C of 2.6.

➢ Find the 3-sigma control limits.

- What is the probability of a point falling outside these control limits when operating at a μ of 2.6.
- If the process average shifts to 4.8, what is the probability of not detecting the shift on the first sample?

(OR)

b) Summarized below is daily analysis of CO_2 in a chemical manufacturing process. Compute 3-day moving averages and moving ranges and establish control charts for monitoring the process and comment on the process.

Date	% of CO_2	Date	% of CO_2
June 1	0.53	11	0.57
2	0.62	12	0.56
3	0.63	13	0.55
4	0.54	14	0.65
5	0.50	15	0.59
6	0.50	16	0.60
7	0.51	17	0.69
8	0.53	18	0.65
9	0.56	19	0.65
10	0.64	20	0.67

14 a i) What is double sampling plan? Explain the OC curve of double sampling plan.

ii) For the double sampling plan, $n_1 = 50$, $c_1 = 1$, $n_2 = 100$ and $c_2 = 3$, determine the average sample number.

(OR)

b. Design a single sampling plan if $\alpha = 0.05$, AQL = 0.01, $\beta = 0.10$ and LTPD = 0.10

15 a) What is a sine bar? Explain how it is used for angle measurement. State the limitations and sources of errors in sine bars.

(OR)

b) Explain the principles and application of te following methods of inspection.
i) Manetic particle test
ii) Dye-penetrant test
iii0 Ultrasonic test