BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2023)

CLASS: BTECH **SEMESTER : VI**
BRANCH: PRODUCTION **SESSION : SP/2023**

SUBJECT: PE314 STATISTICAL QUALITY CONTROL

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

Q.1(a) What is variation, and how is it related to quality? Briefly discuss different types of variations. [2]

Q.1(b) What do you understand by central tendency? Discuss the various measures of the central tendency. Calculate all the measures of central tenancy for the Sample of 12 shafts randomly selected from a machine. [3]

9.8, 10.1, 10.1, 14.5, 10.1, 17.5, 13.9, 20.0, 15.5, 7.8, 14.5, 14.5

Q.2(a) The thickness of a printed circuit board is an important quality parameter. Data on board thickness (in inches) are given in Table for samples of three boards each.

(a) If the specifications are at 0.0630 in. ±¤0.0015 in., what is the value of the process capability ratio *Cp*? [2]

(b) Set up X-bar and *R* control charts. Is the process in statistical control? [3]

Sample No.	1	2	3	4	5	6	7	8	9	10
x1	0.0629	0.063	0.0628	0.0634	0.0619	0.0613	0.063	0.0628	0.0623	0.0631
x2	0.0636	0.0631	0.0631	0.063	0.0628	0.0629	0.0639	0.0627	0.0626	0.0631
x3	0.064	0.0622	0.0633	0.0631	0.063	0.0634	0.0625	0.0622	0.0633	0.0633

For sample size 3 A2=1.02, A3=1.934, d2=1.693, D3=00 , D4= 2.57

Q.3(a) The diameter of cotter pins produced by an automatic machine is a characteristic of interest. Based on historical data, the process average diameter is 15 mm with a process standard deviation of 0.8 mm. If samples of size 4 are randomly selected from the process: [5]

(a) Find the 3 σ control limits for the average diameter.
(b) What is the probability of a false alarm?
(c) If the process mean shifts to 14.5 mm, what is the probability of not detecting this shift on the first sample plotted after the shift?

Q.4(a) List Western Electric Rules for Shewhart Control Charts. [2]

Q.4(b) A sample of 100 cups from a particular dinnerware pattern was selected on each of 25 successive days, and each was examined for defects. The resulting numbers of unacceptable cups are as follows: [3]

Day(i)	1	2	3	4	5	6	7	8	9	10	11	12	13
x_i	7	4	3	6	4	9	6	7	5	3	7	8	4
Day(i)	14	15	16	17	18	19	20	21	22	23	24	25	
x_i	6	2	9	7	6	7	11	6	7	4	8	6	

Set up a control chart to improve the fraction of nonconforming dinnerware produced by this machine.

Q.5(a) What is acceptance sampling? Discuss the advantages of acceptance sampling. [2]

Q.5(b) Discuss the various types of sampling plans. Which sampling plan is superior concerning the number of items inspected and administrative cost? Justify your answer. [3]

PTO

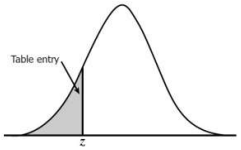

Table1: Standard Normal Probabilities

Table entry for z is the area under the standard normal curve to the left of z.

Z	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-1.90	0.02872	0.02807	0.02743	0.02680	0.02619	0.02559	0.02500	0.02442	0.02385	0.02330
-1.80	0.03593	0.03515	0.03438	0.03362	0.03288	0.03216	0.03144	0.03074	0.03005	0.02938
-1.70	0.04457	0.04363	0.04272	0.04182	0.04093	0.04006	0.03920	0.03836	0.03754	0.03673
-1.60	0.05480	0.05370	0.05262	0.05155	0.05050	0.04947	0.04846	0.04746	0.04648	0.04551
-1.50	0.06681	0.06552	0.06426	0.06301	0.06178	0.06057	0.05938	0.05821	0.05705	0.05592
-1.40	0.08076	0.07927	0.07780	0.07636	0.07493	0.07353	0.07215	0.07078	0.06944	0.06811
4.00	0.99997	0.99997	0.99997	0.99997	0.99997	0.99997	0.99997	0.99997	0.99997	0.99997
4.10	0.99998	0.99998	0.99998	0.99998	0.99998	0.99998	0.99998	0.99998	0.99998	0.99998
4.20	0.99999	0.99999	0.99999	0.99999	0.99999	0.99999	0.99999	0.99999	0.99999	0.99999
4.30	0.99999	0.99999	0.99999	0.99999	0.99999	0.99999	0.99999	0.99999	0.99999	0.99999

::::::22/02/2023::::::M