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

CLASS: B.Tech **SEMESTER : V**
BRANCH: PIE **SESSION : MO/2024**

SUBJECT: PE326 METROLOGY & STATISTICAL QUALITY CONTROL

TIME: 3 Hours **FULL MARKS: 20**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Explain the concept of interchangeability in manufacturing.	[2]	1	
Q.1(b)	Four end bars A, B, C and D are to be calibrated using a calibrated length bar of 100 mm whose actual length is 99.9999mm. The bar B is longer than bar A by 0.0003mm, bar C is longer than bar A by 0.0002mm, while bar D is shorter than bar A by 0.0001mm. The four gauges together have a combination length of 100.0002mm. Determine the corrected (actual) length of each bar.	[3]	1	5
Q.2(a)	Differentiate between allowance and tolerance.	[2]	1	2
Q.2(b)	A Hole and a mating Shaft are to have a nominal assembly size of 40mm.The assembly is to have a maximum clearance of 0.15mm and a minimum clearance of 0.05 mm. The hole tolerance is 2.5 times the shaft tolerance. Determine the limits for hole and shaft.	[3]	1	5
Q.3(a)	Differentiate between traditional and modern definitions of Quality.	[2]	2	2
Q.3(b)	Discuss various measures of central tendency and dispersions. Explain under what conditions each one is used.	[3]	2	2
Q.4	The time to deliver packaged containers by a logistics company is found from samples of size 4. The mean and standard deviation of delivery times is estimated to be 140 hours and 6 hours, respectively. (a) Find the 3ó control limits for the average delivery time. (b) What is the probability of a type I error for 3ó control limits? (c) If the mean delivery time shifts to 145 hours, what is the probability of not detecting this by the first sample after the shift? (d) What is the ARL after the shift? Explain.	[5]	3	5
Q.5(a)	Discuss type-I and type-II errors in statistical process control. If control limits are moved away from the center line, what will be the effect on type-I & type-II errors?	[2]	3	3
Q.5(b)	A quality control inspector at the Cocoa Colla soft drink company has taken 25 samples with 4 observations each of the volume of bottles filled. If the average range is 0.29 ounces and the average mean of the observations is 15.95 ounces, develop 3σ control limits for X-bar and R charts. **(For n=4 A2= 0.73 D3= 0, D4=2.28)**	[3]	3	5

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