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

CLASS: IMSc **SEMESTER : VI**
BRANCH: MATH **SESSION : SP/2023**

SUBJECT: MA316 STATISTICAL QUALITY CONTROL AND RELIABILITY

TIME: 3 Hours **FULL MARKS: 50**

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)	Mention any five benefits of statistical quality control.	[5]	1	1.12
Q.1(b)	Explain the importance of process control and product control in the industries.	[5]	1	1.23
Q.2(a)	Obtain the control limits of Range-chart both for standard specified and standard not specified.	[5]	2	1.20
Q.2(b)	The number of defects in 12 newly purchased TV sets of a particular brand are given below. Using a suitable control chart, comment on the state of control. TV set no: 1 2 3 4 5 6 7 8 9 10 11 12 No. of defects: 2 4 1 3 7 0 9 4 5 1 2 3	[5]	2	1.25
Q.3(a)	Distinguish between single and double sampling inspection plans. Obtain the expressions of Average Sample Number (ASN) and Average amount of total inspection (ATI) for both the plans.	[5]	3	1.32
Q.3(b)	Why is a sequential sampling plan useful? Explain Wald's Sequential Probability Ratio Test (SPRT) for testing the null hypothesis H_0:$p=p_0$ against the alternative hypothesis H_1: $p=p_1$.	[5]	3	1.30
Q.4(a)	State and prove the lack of memory property of exponential distribution and explain why this property makes this distribution useful in reliability theory.	[5]	4	1.31
Q.4(b)	Find the mean and variance of lognormal distribution. Mention some application areas of this distribution.	[5]	4	1.10
Q.5(a)	Define reliability function. How is it related to distribution function of a random variable? A manufacturer wants to promote a new brand of electric bulb in the market. A random sample of 12 bulbs are put to test. These 12 bulbs survive for hours as given below before failing: 381, 638, 890, 956, 135, 462, 240, 820, 750, 586, 179, 912 Without making any distributional assumption, find the probability that a new bulb purchased of this brand will survive for at least 700 hours?	[5]	5	1.20
Q.5(b)	Consider two systems S_1 and S_2. System S_1 has two components, connected in series, with their life time distributions being independently and exponentially distributed with mean m and n. System S_2 also has two components, connected in parallel, with their life time distributions being independently and exponentially distributed with mean s and t. Estimate the reliability of the systems S_1 and S_2.	[5]	5	1.25

::::::28/04/2023::::::M