BIRLA INSTITUTE OF TECHNOLOGY
MESRA – 835215, RANCHI, INDIA

UG

Name: …… Roll No.: ……..

Branch: …… Signature of Invigilator: ……

Semester: VIth Date: 25/04/2022 (MORNING)

Subject with Code: MA316 STATISTICS QUALITY CONTROL & RELIABILITY

	Section A (30)	Section B (20)	Total Marks (50)
Marks Obtained			

INSTRUCTION TO CANDIDATE

1. The booklet (question paper cum answer sheet) consists of two sections. First section consists of MCQs of 30 marks. Candidates may mark the correct answer in the space provided / may also write answers in the answer sheet provided. The Second section of question paper consists of subjective questions of 20 marks. The candidates may write the answers for these questions in the answer sheets provided with the question booklet.
2. The booklet will be distributed to the candidates before 05 minutes of the examination. **Candidates should write their roll no. in each page of the booklet.**
3. Place the Student ID card, Registration Slip and No Dues Clearance (if applicable) on your desk. All the entries on the cover page must be filled at the specified space.
4. Carrying or using of mobile phone / any electronic gadgets (except regular scientific calculator)/chits are strictly prohibited inside the examination hall as it comes under the category of unfair means.
5. No candidate should be allowed to enter the examination hall later than 10 minutes after the commencement of examination. Candidates are not allowed to go out of the examination hall/room during the first 30 minutes and last 10 minutes of the examination.
6. Write on both side of the leaf and use pens with same ink.
7. The medium of examination is English. Answer book written in language other than English is liable to be rejected.
8. All attached sheets such as graph papers, drawing sheets etc. should be properly folded to the size of the answer book and tagged with the answer book by the candidate at least 05 minutes before the end of examination.
9. The door of examination hall will be closed 10 minutes before the end of examination. Do not leave the examination hall until the invigilators instruct you to do so.
10. Always maintain the highest level of integrity. Remember you are a BITian.
11. Candidates need to **submit the question paper cum answer sheets before leaving the examination hall**.

Birla Institute of Technology, Mesra

End Semester Exam SP 2022

Class: IMSc **Semester VI**

Branch: Math **Session: SP/2022**

Subject MA 316 Statistical Quality Control and Reliability

Full marks: 50 **Time: 2 hours**

I. Section A (30 marks) has 15 multiple choice questions, each carrying 2 marks.

II. Section B (20 marks) has 4 short answer type questions, each carrying 5 marks.

III. Answer all questions. Missing data, if any, may be assumed suitably.

Section A (MCQ) 30 marks

Choose the right answer (only one of the given four options to be chosen)

1. Chance or random variation in the manufactured product is
   (a) Controllable (b) not controllable (c) sometimes controllable (d) depends on the product [2 marks]
2. Control charts consist of
   (a) Three control lines (b) four control lines (c) two control lines (d) none of these [2 marks]
3. R charts are preferable over σ-charts because
   (a) R and σ fluctuate together for small samples (b) R is easily calculable (c) R charts are economical (d) all of these [2 marks]
4. If μ and σ are the process mean and process SD then the control limits μ-3σ and μ+3σ are called
   (a) Modified control limits (b) natural control limits (c) specified control limits (d) none of these [2 marks]
5. Acceptance sampling plans are preferable due to
   (a) Economy in inspection (b) protection of perishable items (c) increased efficiency in the inspection of items (d) all of these [2 marks]
6. The probability of accepting a lot with quality p_t with usual notation is termed as
   (a) Consumer's risk (b) type I error (c) producer's risk (d) none of these [2 marks]

7. The fraction defective on the basis of which a lot is not rejected except for a small number of times is called (a) Lot Tolerance Fraction Defective (b) Rejecting Quality Level (c) Acceptance Quality Level (d) none of these [2 marks]

8. The graph of proportion of defectives in the lot versus average sample number is called
   (a) OC curve (b) ASN curve (c) power curve (d) none of these [2 marks]

9. The decision about the acceptance or rejection of a lot through a single sampling plan is reached by considering
   (a) Number of defectives in the sample and acceptance number
   (b) The acceptance quality level (c) lot tolerance percent defective (d) all of these [2 marks]

10. For a lot with 100% defectives, the OC function is
    (a) Zero (b) unity (c) infinity (d) none of these [2 marks]

11. In SPRT, the lot is accepted if
    (a) $\lambda_m \leq \beta/(1-\alpha)$ (b) $\lambda_m \geq \beta/(1-\alpha)$ (c) $\lambda_m \leq (1-\beta)/\alpha$ (d) $\lambda_m \geq (1-\beta)/\alpha$ [2 marks]

12. Sampling inspection plans are credited to (a) Dr. Shewhart (b) Abraham Wald (c) Dodge and Romig (d) none of these [2 marks]

13. The 3-sigma and 6-sigma limits in SQC are applications of
    (a) Jensen's inequality (b) Cauchy-Schwartz inequality (c) Chebyshev's inequality (d) none of these [2 marks]

14. For exponential distribution with parameter m, mean is related to variance as

    (a) mean=variance (b) mean > variance (c) variance > mean (d) depends on m [2 marks]

15. If X and Y are independent and exponentially distributed with parameters m and n respectively then Min(X,Y) is also exponentially distributed with parameter
    (a) mn (b) m+n (c) m/n (d) none of these [2 marks]

Section B **20 marks**

Short Answer Type Questions

16. What do you mean by statistical quality control? Give four strong reasons to justify its necessity in an industry. [5 marks]

17. What is the rationale behind setting of control limits?

OR

Sixteen boxes of electric switches each containing 20 switches were randomly selected from a lot of switch boxes and inspected for the number of defects per box. The following data resulted:-

Box No:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
No. of defects per box:	12	15	9	14	18	26	8	6	11	12	16	13	19	18	14	21

Calculate 3-Sigma limits for C chart and draw your conclusion. [5 marks]

18. From the following data, given lot size=1000, construct 3-sigma limits for p-chart and comment of the state of control of the process.

Lot no:	1	2	3	4	5	6	7	8	9	10	11	12
No. of defectives:	22	40	36	32	42	40	30	44	42	38	70	80

OR

Critically compare single and double sampling inspection plans. [5 marks]

19. Why is exponential distribution important in reliability? Which property makes it important? Justify your answer with supporting mathematical proof. [5 marks]

Date of Exam: 25.04. 2022