B.Tech. DEGREE EXAMINATION, MAY 2022
Fifth Semester

18MAB301T – PROBABILITY AND STATISTICS
(For the candidates admitted from the academic year 2018-2019 to 2019-2020)

Note:
(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.
(ii) **Part - B** should be answered in answer booklet.

Time: 2½ Hours

Max. Marks: 75

| | Marks | BL | CO | PO |

PART – A (25 × 1 = 25 Marks)
Answer **ALL** Questions

1. If the occurrence of an event A is affected by the occurrence of the another event B, then $P(A \cap B)$ (1 1 1 2)
(A) $P(A)P(B)$
(B) $P(A)+P(B)$
(C) $P(A) \cdot P(B/A)$
(D) $P(A)+P(B)-P(A \cap B)$

2. If X and Y are random variables, then $E(X - \overline{X}) =$ (1 1 1 2)
(A) 1
(B) 1/2
(C) 2
(D) 0

3. If $E(X^2) = 8$ and $E(X) = 2$, then $Var(X)$ is _____ (1 1 1 2)
(A) 1
(B) 2
(C) 3
(D) 4

4. If the random variable X has the p.d.f $f(x) = \begin{cases} ax^3, 0 < x < 1 \\ 0 \quad otherwise \end{cases}$ then the value of 'a' is (1 1 1 2)
(A) 3
(B) 4
(C) 1/2
(D) 3/4

5. A box contains 4 red, 5 white and 6 black balls. What is the probability that two balls drawn are red and black? (1 1 1 2)
(A) 10/15
(B) 2/3
(C) 8/5
(D) 18/35

6. The mean and variance of a binomial distribution is (1 1 2 2)
(A) $\mu = np, \sigma^2 = npq$
(B) $\mu = npq, \sigma^2 = np$
(C) $\mu = nq, \sigma^2 = npq$
(D) $\mu = np, \sigma^2 = pq$

7. If the random variable X follows a Poisson distribution with mean 3, then $P(X=0)$ is (1 1 2 2)
(A) e^{-3}
(B) e^3
(C) e^2
(D) e

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27. a. The atoms of a radioactive element are randomly disintegrating. If every gram of the element, on an average, emits 3.9 alpha particles per second, then what is the probability that during the next second the number of alpha particles emitted from 1 gram is (10 3 2 2)
    (i) At most 6
    (ii) At least 2
    (iii) At least 3 and at most 5?

    (OR)

b. In a distribution exactly normal 7% of the items are under 35 and 89% are under 63. What are the mean and standard deviation of the distribution? (10 3 2 2)

28. a. The table represent the value of protein content from cow's milk and buffalo's milk at a certain level. Examine if these differences are significant. (10 3 3 1)

Cow's milk	1.82	2.02	1.88	1.61	1.81	1.54
Buffalo's milk	2	1.83	1.86	2.03	2.19	1.88

    (OR)

b. Two horses A and B were tested according to the time (in seconds) to run a particular tract with the following. (10 3 3 2)

Horse A	28	30	32	33	29	34
Horse B	29	30	30	27	29	-

Test whether is there any significant difference between the two Horses (F-test).

29. a. Calculate the correlation coefficient for the following heights (in inches) of fathers (X) and their sons (Y). (10 4 4 2)

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

    (OR)

b. Four machines A, B, C and D are used to produce a certain kind of cotton fabric, samples of size 4 with each unit as 100 square meters are selected from the outputs of the machines at random and the number of flows in each 100 square metres are counted, with the following result. (10 4 4 2)

A	B	C	D
8	6	14	20
9	8	12	22
11	10	18	25
12	4	9	23

30. a. The following are sample means and ranges for ten samples, each of size 5. Construct the control chart for mean and range and comment on the nature of control. (10 1 5 2)

Sample no.	1	2	3	4	5	6	7	8	9	10
Mean $\overline{X}$	12.8	13.1	13.5	12.9	13.2	14.1	12.1	15.5	13.9	14.2
Range R	2.1	3.1	3.9	2.1	1.9	3.0	2.5	2.8	2.5	2

    (OR)

b. Construct a control chart for the proportion of detectives for the following data. (10 2 5 1)

Sample no.	1	2	3	4	5	6	7	8	9	10
No. of inspected	90	65	85	70	80	80	70	95	90	75
No. of defectives	9	7	3	2	9	5	3	9	6	7

* * * * *

8. The MGF of geometric distribution is   1   1   2   2
   (A) $\dfrac{1}{1-qe^t}$
   (B) $\dfrac{1}{1-pe^t}$
   (C) $\dfrac{q}{1-pe^t}$
   (D) $\dfrac{pe^t}{1-qe^t}$

9. The mean of uniform distribution is   1   1   2   2
   (A) $\dfrac{a+b}{2}$
   (B) $\dfrac{a+b}{4}$
   (C) $\dfrac{a-b}{2}$
   (D) $\dfrac{a-b}{4}$

10. In a normal distribution about 99% of the observation lie between   1   1   2   2
    (A) $\mu \pm 2\sigma$
    (B) $\mu \pm \sigma$
    (C) $\mu \pm 3\sigma$
    (D) $\mu \pm 4\sigma$

11. A type I error occurs when   1   1   3   2
    (A) The null hypothesis is incorrectly accepted when it is false
    (B) The null hypothesis is incorrectly rejected when it is true
    (C) The sample mean differs from the population mean
    (D) The test is biased

12. The standard deviation of a sampling distribution is called   1   1   3   2
    (A) Sampling error
    (B) Sample error
    (C) Standard error
    (D) Simple error

13. The degree of freedom for t-test based on n observations is   1   1   3   2
    (A) $2n-1$
    (B) $n-2$
    (C) $2(n-1)$
    (D) $n-1$

14. The rang of F-distribution is   1   1   3   2
    (A) 0 to ∞
    (B) $-\infty$ to ∞
    (C) -1 to ∞
    (D) 1 to ∞

15. The value set for α is known as   1   1   3   2
    (A) The rejection level
    (B) The acceptance level
    (C) The significance level
    (D) The error in the hypothesis test

16. The range of simple correlation coefficient is   1   1   4   2
    (A) 0 to ∞
    (B) $-\infty$ to ∞
    (C) 0 to 1
    (D) -1 to 1

17. The regression coefficients are b_1 and b_2 then the correlation coefficient 'r' is   1   1   4   2
    (A) b_1 / b_2
    (B) b_2 / b_1
    (C) $b_1 b_2$
    (D) $\pm\sqrt{b_1 b_2}$

18. In two-way classification the data are classified according to _____ different factor.   1   1   4   2
    (A) Two
    (B) One
    (C) Five
    (D) Six

19. For the equation $y = 3x - 2$, if the mean of y is 10, what is the mean of x?   1   1   4   2
    (A) 8
    (B) 28
    (C) 4
    (D) 12

20. The correlation between the two variables is unity, there is   1   1   4   2
    (A) Perfect correlation
    (B) Perfect positive correlation
    (C) Perfect negative correlation
    (D) No correlation

21. The technique of control charts was pioneered by   1   1   5   2
    (A) Goset
    (B) Robert
    (C) W.A. Shewhart
    (D) R.A. Fisher

22. In the control chart, the central line CL is plotted as a _____ line.   1   1   5   2
    (A) Dotted
    (B) Scattered
    (C) Empty
    (D) Bold

23. c-chart is used when $\bar{c} \geq$ _____   1   1   5   2
    (A) 1
    (B) 2
    (C) 3
    (D) 4

24. $\overline{X}$ and R charts are employed to control the mean and _____ respectively of characteristic.   1   1   5   2
    (A) Median
    (B) Mode
    (C) Range
    (D) Skewness

25. If 'd' is the number of defectives in a sample of size 'n' then the sample of proportion defective is _____   1   1   5   2
    (A) $p = \dfrac{d}{n}$
    (B) $p = d$
    (C) $p = \dfrac{d}{s}$
    (D) $p = \dfrac{d}{\sqrt{n}}$

PART – B (5 × 10 = 50 Marks)
Answer ALL Questions

                                    Marks   BL   CO   PO

26. a. A bag contains 5 balls and it is not known how many of them are white. Two balls are drawn at random from the bag and they are noted to be white. What is the chance that all the balls in the bag are white?   10   3   1   2

(OR)

b. A discrete random variable X has the following distribution.   10   2   1   2

X	0	1	2	3	4	5	6	7	8
P(X=a)	a	3a	5a	7a	9a	11a	13a	15a	17a

   (i) Find the value of 'a'
   (ii) $P(X < 3)$
   (iii) $P(X \geq 3)$
   (iv) $P(0 < X < 3)$
   (v) Cumulative distribution function