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**BRAINWARE UNIVERSITY**

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Department of Allied Health Sciences
Brainware University
Barasat, Kolkata- 700125

Term End Examination 2025-2026**Programme – M.Sc.(BI)-2025****Course Name – Biomathematics and Biostatistics****Course Code - MBI20404****(Semester II)****Full Marks : 60****Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question)

1 x 15=15

1. Choose the correct alternative from the following :

- (i) The A.M. of 4 observations 3, 20, 7, 45 is calculated as
 - a) 17.65
 - b) 15.65
 - c) 18.75
 - d) 19.25
- (ii) The median of 6 observations -14, 2, 6, 1, 40, -9 is computed as
 - a) 4.5
 - b) 1.5
 - c) 3.5
 - d) 2.5
- (iii) Standard deviation (S.D.) of 10 equal observations is computed as
 - a) 0
 - b) 2
 - c) 3
 - d) 4
- (iv) The third order raw moment of 10, 0, -10 is calculated as
 - a) -1
 - b) 0
 - c) 1
 - d) 2
- (v) A fair die is rolled once. Select the sample space for this random experiment.
 - a) {4,5,6}
 - b) {1,2,3}
 - c) {1,2,3,4,5,6}
 - d) {1,3,6}
- (vi) By axiomatic definition of probability, $P(\Omega)$ is identified as
 - a) $1/2$
 - b) 1
 - c) $2/3$
 - d) 0
- (vii) Select the correct answer. From a pack of 52 cards, one card is drawn at random. The probability that an ace is drawn is
 - a) $3/13$
 - b) $1/13$
 - c) $1/52$
 - d) $1/26$
- (viii) The events {1}, {5}, {3}, {4} for the random experiment "rolling a fair die once" are identified as
 - a) mutually exclusive and exhaustive
 - b) mutually exhaustive
 - c) mutually exclusive
 - d) mutually independent
- (ix) In a deck of 52 cards, select the probability of drawing a heart card given that it's a red card.
 - a) $1/2$
 - b) $1/4$
 - c) $1/13$
 - d) $1/26$
- (x) Given that $cov(X, Y) = 0.56$, $\bar{X} = 1.5$, $\bar{Y} = 2.5$, $var(X) = 2$ and $var(Y) = 4$, the regression line of Y on X is estimated as
 - a) $Y = -2.08 + 0.28X$
 - b) $Y = 2.08 - 0.28X$

- c) $Y = 2.08 + 0.28X$ d) $Y = -2.08 - 0.28X$
- (xi) For a regression line $Y = a + bX$ if the estimated values of a and b are -0.64 and 0.54 , then Y is estimated at $X = 6$ as
- a) 2.4 b) 2.6
c) 3 d) 3.8
- (xii) Estimate the number of possible samples of size 2 out of 5 population size in SRSWR.
- a) 10 b) 32
c) 25 d) 15
- (xiii) Suppose 10 coin is tossed and the outcomes are: H, H, T, T, T, T, H, T, H. Estimate the MLE of p , probability of success (getting head).
- a) 0.4 b) 0.5
c) 0.7 d) 0.3
- (xiv) Select the correct option. Deterministic models are best suited for
- a) Small populations with randomness b) Large populations with average behavior
c) Genetic inheritance modeling d) Random biological processes
- (xv) Select the correct option. In the Wright--Fisher model, the variance of allele frequency is inversely proportional to
- a) Selection coefficient b) Mutation rate
c) Effective population size d) Migration rate

Group-B

(Short Answer Type Questions)

3 x 5=15

2. Determine the quartile deviation (Q.D.) of 105, 78, 210, 162, 89, 232, 148, 210, 75. (3)
3. a) Define mutually exclusive events. (3)
b) Define sure event.
c) Define mutually exhaustive events.
4. For a normal distribution $N(0, 3)$, calculate (i) $E(X)$, (ii) $E(X^2)$, (iii) $Var(X)$. (3)
5. Explain a reaction–diffusion model. (3)
6. Explain the measure of dispersion. Analyze any two measures of dispersion in brief. (3)

OR

Define regression coefficients b_{YX} and b_{XY} . Show that $b_{YX} \times b_{XY} = r^2$ where r is the Pearson's correlation coefficient. (3)

Group-C

(Long Answer Type Questions)

5 x 6=30

7. A random sample of size $n(> 100)$ is drawn from a population having $N(\mu, \sigma^2)$ distribution, say $y_1, \dots, y_n$ ($\sigma > 0$). Construct a 95% confidence interval for μ for testing $H_0 : \mu = 15$ against $H_1 : \mu \neq 15$. (Given that $Z_{0.975} = 1.96$.) (5)
8. Suppose $X \sim P(3)$ distribution. Calculate (i) $P(X = 3)$, (ii) $P(X < 3)$, (iii) $P(X > 3)$. (5)

9. Discuss on skewness. Explain the measures of skewness. (5)
10. Discuss on Poisson distribution. (5)
11. Explain travelling wave solutions in reaction–diffusion systems and discuss their biological significance. (5)
12. There are 4 families F1, F2, F3 and F4 consisting of 4 men and 2 women, 3 men and 1 woman, 1 man and 5 women, 2 men and 2 women respectively. 2 men and 4 women are chosen at random from all the families. Calculate the probability that the members are selected neither from F1 nor from F2. (5)

OR

For a Normal distribution $N(0,1)$, calculate μ_2 and μ_3 . (5)

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