**B. Tech. 5th Semester Biotechnology, End–term Exam., 2018-19**

**Subject: - Biostatistics** **Paper Code:- MA1501**

Time: - 3 Hrs Full Marks: 60

**INSTRUCTIONS:**

There are **Six** questions in this paper. Attempt **ALL** questions. Each question carries equal marks. Statistical Tables and non-programmable calculator are allowed.

1. Choose the correct answer: 2X5

(a) If A and B are two events and the probability $P(B) \neq 1$, then $\dfrac{P(A)-P(A\cap B)}{1-P(B)}$ equals

(i) $P(A/\overline{B})$ (ii) $P(A/B)$ (iii) $P(\overline{A}/B)$ (iv) $P(\overline{A}/\overline{B})$

(b) If A and B are two events such that P(A)=.3, P(B)=.6 and $P(B/A)=.5$ then $P(A/B)$ is equal to

(i) $\frac{2}{5}$ (ii) $\frac{5}{8}$ (iii) $\frac{1}{4}$ (iv) $\frac{3}{5}$

(c) Let $X$ be a continuous random variable with probability density function:

$$f(x) = \begin{cases} \frac{1}{2\sqrt{\pi}} e^{-\frac{x^2}{4}}; & -\infty < x < \infty \\ 0, & \text{otherwise} \end{cases}$$, then its moment generating function $M_X(t)$ is

(i) $e^{t^2}$ (ii) $e^{-t^2}$ (iii) $e^{\frac{t^2}{2}}$ (iv) $e^{-\frac{t^2}{2}}$

(d) A random variable $X$ has a Poisson distribution.
If $4\{P(X=2)\} = \{P(X=1) + P(X=0)\}$ then the variance of $X$ is
(i) 3 (ii) 2 (iii) 1 (iv) 4

(e) The moment generating function of a continuous random variable $X$ be given as: $M_X(t) = (1-t)^{-9}$ $|t| < 1$. Then its mean and variance is

(i) (9, 1/9) (ii) (9, 9) (iii) (3, 3) (iv) (1/9, 1/9)

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2. (a) State and prove Bay's Theorem.

(b) For any two events A and B, prove that $P(A\cap\overline{B}) = P(A) - P(A\cap B)$.

3. (a) The members of a consulting firm rent cars from three rental agencies: 60% from agency A, 30% from agency B and remaining from agency C. If 9% of the cars from agency A need a tune-up, 20% from B, and 6% of the cars from C need a tune-up, what is the probability that a rental car needs a tune-up, then it came from agency B?

(b) For events $A_1, A_2, A_3, A_4, A_5, \ldots A_n$, assuming $P(\bigcup_{i=1}^{n} A_i) \le \sum_{i=1}^{n} P(A_i)$ then prove that $P(\bigcap_{i=1}^{n} A_i) \ge \sum_{i=1}^{n} P(A_i) - (n-1)$.

4. (a) Given the joint density function of $X$ and $Y$ as: $f(x,y) = \begin{cases} \frac{1}{2} x\, e^{-y}; & 0 < x < 2,\ y \ge 0 \\ 0 & elsewhere. \end{cases}$

Find the probability density function of $X + Y$.

(b) If $X$ and $Y$ are two random variables with variances $\sigma_x^2$ and $\sigma_y^2$ respectively and $r$ is the coefficient of correlation between them. If $u = x + ky$ and $v = x + \left(\frac{\sigma_x}{\sigma_y}\right) y$. Find the value of $k$ so that $u$ and $v$ are uncorrelated.

5. (a) The following marks have been obtained by a class of students in Statistics (out of 100):

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Paper I | 80 | 45 | 55 | 56 | 58 | 60 | 65 | 68 | 70 | 75 | 85 |
| Paper II | 82 | 56 | 50 | 48 | 60 | 62 | 64 | 65 | 70 | 74 | 90 |

Compute the coefficient of correlation for the above data. Find the lines of regression.

(b) Fit a second degree parabola to the following data, where x is the independent variable:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| y | 2 | 6 | 7 | 8 | 10 | 11 | 11 | 10 | 9 |

6. (a) A test of the breaking strengths of 6 ropes manufactured by a company showed a mean breaking strength of 3515 kg and a standard deviation of 66 kg, whereas the manufacturer claimed a mean breaking strength of 3630 kg. Can we support the manufacturer's claim at a level of significance of (i) **0.05** (ii) **0.01**?.

(b) How large a sample should one take in order to be (i) 95%, (ii) 99.73% confident that a population standard deviation will not differ from a sample standard deviation by more than 2%?

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