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22MAU309N

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2025
(Third Semester)

Branch - **MATHEMATICS**

MATHEMATICAL STATISTICS - I

Time: Three Hours   Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions
ALL questions carry **EQUAL** marks   (10 × 1 = 10)

Question No.	Question	K Level	CO
1	Given A B and C are arbitrary events, What is the expression for all the three events to happen. (a) $A\cap B\cap C$ (b) $A\cup B\cup C$ (c) $\overline{A\cap B\cap C}$ (d) $\overline{A\cup B\cup C}$	K1	CO1
2	$P(A\cap\overline{B})$ is (a) $P(A)-P(A\cap B)$ (b) $P(A)-P(A\cup B)$ (c)$P(A)-P(B)$ (d) $P(B)-P(A)$	K2	CO1
3	*Find the* $Var(2X+3)$ is (a) 4 $Var(X)$ (b) 9 $Var(X)$ (c) 3 $Var(X)$ (d) 13$Var(X)$	K1	CO2
4	If $E(X+c)=10$ and $E(X-c)=6$, then the value of c is (a) 1 (b) 2 (c) $\frac{1}{2}$ (d) 0	K2	CO2
5	If X and Y are independent, then (a) $Cov(x,y)=1$ (b) $Cov(x,y)\neq 1$ (c) $Cov(x,y)=0$ (d) $Cov(x,y)=0$	K1	CO3
6	*Recall the* $E(E(X\|Y))=$ ________ (a) $E(X\|Y)$ (b) $E(X)$ (c) $E(Y)$ (d) none of these	K2	CO3
7	Given X is a Poisson variable with $P(X=1)=P(X=2)$, then $P(X=4)$ is (a) $\frac{3}{2}e^{-2}$ (b) $\frac{2}{3}e^{3}$ (c) $\frac{2}{3}e^{-2}$ (d) $\frac{3}{2}e^{2}$	K2	CO4
8	For sufficiently large value of n, the t distribution tends to _______ distribution. (a) Binomial (b) normal (c) Standard normal (d) F	K2	CO4
9	Pick one of the following which is not a random sampling. (a) Tippet's random number (b) throwing a dice (c) draw a lottery (d) none of these	K1	CO5
10	The principle of least squares states that the parameters involved in f(x) should be chosen in such a way that $\sum y_i - f(x)$ (a) minimum (b) maximum (c) equal (d) different	K2	CO5

SECTION - B (35 Marks)

Answer **ALL** questions
ALL questions carry **EQUAL** Marks   (5 × 7 = 35)

Question No.	Question	K Level	CO
11.a.	State and Prove Boole's inequality.	K2	CO1
	(OR)		
11.b.	From a city population the probability of selecting (i) a male or a smoker is $\frac{7}{10}$ (ii) a male smoker is $\frac{2}{5}$ (iii) a male if a smoker is already selected is $\frac{2}{3}$. Find the probability of selecting (a) non-smoker (b) a male and (c) a smoker, if a male is first select.		
12.a.	Given X be continuous random variable with p.d.f $f(x)=\begin{cases} ax & 0\le x\le 1 \\ a & 1\le x\le 2 \\ -ax+3a & 2\le x\le 3 \\ 0 & elsewhere \end{cases}$ Determine the constant 'value a' and Compute $P(X\le 1.5)$	K3	CO2
	(OR)		

Cont...

<table>
<tr><td>12.b.</td><td>State and Prove addition theorem of expectation of two events and discuss its generalization.</td><td></td><td></td></tr>
<tr><td>13.a.</td><td>(a) Given the moments of variate X are defined by
$E(X^r) = 0.6, r = 1,2,3 ....$ Show that $P(X = 0) = 0.4$,
$P(X = 1) = 0.6, P(X \geq 2) = 0$
(b) Find the moment generating function of the random variable whose moments are $\mu_r' = (r+1)!\,2^r$.</td><td rowspan="3">K2</td><td rowspan="3">CO3</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>13.b.</td><td>Given X and Y are two random variable having joint density function
$f(x,y) = \begin{cases} \frac{1}{8}(6-x-y) & 0 \leq x < 2,\ 2 \leq y < 4 \\ 0 & otherwise \end{cases}$
Find (i) $P(X < 1 \cap Y < 3)$ (ii) $P(X + Y < 3)$ (iii) $P(X < 1 | Y < 3)$</td></tr>
<tr><td>14.a.</td><td>Out of 800 families with four children each, how many families would be expected to have (i) two boys and two girls (ii) at least one boy (iii) at most two girls. (iv) children of both sexes. Assume equal probability for boys and girls.</td><td rowspan="3">K4</td><td rowspan="3">CO4</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>14.b.</td><td>In a partially destroyed laboratory record of an analysis of correlation data, the following results only are legible: V(*X*)= 1. and the regression equations are
$3x + 2y = 26$ and $6x + y = 31$. Find (i) The mean value of X and Y (ii) The standard deviation of Y and (iii) Correlation coefficient between X and Y.</td></tr>
<tr><td>15.a.</td><td>Fit a straight line to the following data
<table><tr><td>X</td><td>1</td><td>2</td><td>3</td><td>4</td><td>6</td><td>8</td></tr><tr><td>Y</td><td>2.4</td><td>3.0</td><td>3.6</td><td>4</td><td>5</td><td>6</td></tr></table></td><td rowspan="3">K3
(OR)</td><td rowspan="3">CO5</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>15.b.</td><td>Fit a parabola of second degree to the following data
<table><tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Y</td><td>1</td><td>1.8</td><td>1.3</td><td>2.5</td><td>6.3</td></tr></table></td></tr>
</table>

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

<table>
<tr><th>Question No.</th><th>Question</th><th>K Level</th><th>CO</th></tr>
<tr><td>16</td><td>The probabilities of X, Y and Z becoming managers are $\frac{4}{9},\frac{2}{9}$ and $\frac{1}{3}$ respectively. The probabilities that the bonus scheme will be introduced, if X, Y and Z becomes managers are $\frac{3}{10},\frac{1}{12}$ and $\frac{4}{5}$ respectively, then (i) What is the probability that bonus scheme will be introduced (ii) if the bonus scheme has been introduced, what is the probability that the manager appointed was X?</td><td>K2</td><td>CO1</td></tr>
<tr><td>17</td><td>A random variable X has the following probability function.
(i) Find k (ii) Evaluate $P(X < 6), P(X \geq 6)$ and $P(0 < X < 5)$
(iii) If $P(X \leq a) > \frac{1}{2}$ find the minimum value of 'a' and (iv) Determine the distribution function of X.
<table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>P(x)</td><td>0</td><td>k</td><td>$2k$</td><td>$2k$</td><td>$3k$</td><td>k^2</td><td>$2k^2$</td><td>$7k^2 + k$</td></tr></table></td><td>K3</td><td>CO2</td></tr>
<tr><td>18</td><td>A two-dimensional random variable (X, Y) have a joint probability mass function $P(x, y) = \frac{1}{27}(2x + y)$, where x and y can assume only the integer values 0,1 and 2. Find the conditional distribution of Y for X=x. $P(Y/X = x)$.</td><td>K2</td><td>CO3</td></tr>
<tr><td>19</td><td>Fit a Poisson distribution for the following data
<table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>Total</td></tr><tr><td>f</td><td>142</td><td>156</td><td>69</td><td>27</td><td>5</td><td>1</td><td>400</td></tr></table></td><td>K3</td><td>CO4</td></tr>
<tr><td>20</td><td>Fit an exponential curve of the form $Y = ab^X$ to the following data
<table><tr><td>X</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr><tr><td>Y</td><td>1.0</td><td>1.2</td><td>1.8</td><td>2.5</td><td>3.6</td><td>4.7</td><td>6.6</td><td>9.1</td></tr></table></td><td>K3</td><td>CO5</td></tr>
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Z-Z-Z END