RV College of Engineering®
Mysore Road, RV Vidyaniketan Post,
Bengaluru - 560059, Karnataka, India

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DEPARTMENT OF MATHEMATICS

Course: Linear Algebra and Probability Theory	**Quiz-II**	**Maximum marks: 10**
Course code: MA231TC	**Third semester 2023-2024** **Branch: CS, CD, CY**	**Time: 11:45AM-12:15PM** **Date: 20-02-2024**

Name:	**Branch:**	**USN:**

***Instructions to students**: Rough work can be done at the backside of the sheet.*

Sl. No.	**Questions**	M	BTL	CO
1	4% of the switches manufactured by a firm are found to be defective. Using Poisson distribution, the probability that a box containing 150 switches contain 2 or more defective switches is _____. **Ans: 0.9826**	1	2	2
2	A large chain retailer purchases a certain kind of electronic device from a manufacturer. The manufacturer indicates that the defective rate of the device is 3%. The inspector randomly picks 20 items from a shipment. Using binomial distribution, the probability that there will be at least one defective item among these 20 is _____. **Ans: 0.4562**	1	2	2
3	A survey indicates that people use their cellular phones an average of 1.5 years before buying a new one. The standard deviation is 0.25 year. Suppose a cellular phone user is selected at random assumes a normal random variable. The probability that the user will use their current phone for less than 1 year before buying a new one is _____. **Ans:0.0228**	2	2	2
4	If $h(x,y)=\begin{cases} kxy^2, 0<x<2,\ 0<y<1 \\ 0, \quad otherwise \end{cases}$ is a joint probability density function, then the constant k is _____. **Ans: $k = 1.5$**	1	1	1
5	Let $T:\mathbb{R}^2 \to \mathbb{R}^2$ be a linear transformation and $T(1,0) = (1,-1)$ and $T(0,1) = (0,2)$. Then the image of $(3,1)$ is _____ and the preimage of $(0,4)$ is _____. **Ans: $T(3,1) = (3,-1)$ and preimage of $(0,4) = (0,2)$**	2	2	2
6	The Rotation matrix through an angle of 60° in anticlockwise direction is _____. **Ans:** $\begin{bmatrix} 1/2 & -\sqrt{3}/2 \\ \sqrt{3}/2 & 1/2 \end{bmatrix}$	1	1	2
7	The projection of the vector $(1,2,3)^T$ onto the vector $(1,1,1)^T$ is _____. **Ans: $(2,2,2)^T$**	1	1	2
8	The nullity of a 5×3 matrix (Tick the correct option) (i) **Can be any number from zero to three**. (ii) Must be two. (iii) Can be any number from two to five. (iv) Must be zero. (v) Can be any number from zero to five. (vi) Can be any number from zero to two.	1	1	1

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Sl. No.	**Questions**	M	BTL	CO
1	A sales firm receives, on average, 3 calls per hour on its toll-free number. Using Poisson distribution, for any given hour, the probability that it will receive at least 2 calls is _____. **Ans: 0.8008**	1	2	2
2	Suppose that the amount of time one spends in a bank is exponentially distributed with mean ten minutes. The probability that a customer will spend more than thirteen minutes in the bank is _____. **Ans: 0.2725**	1	2	2
3	A survey was conducted to measure the heights of men. In the survey, respondents were grouped by age. In the 20-29 age group, the heights were normally distributed, with a mean of 69.9 inches and a standard deviation of 3.0 inches. A participant is randomly selected, the probability that his height is between 66 and 72 inches is _____. **Ans: 0.6612**	2	2	2
4	If $f(x,y) = \begin{cases} cx^2y, 0 < x < 2,\ 1 < y < 2 \\ 0, \quad otherwise \end{cases}$ is a joint probability density function, then the constant c is _____. **Ans: $c = 0.1875$**	1	1	1
5	Let $T: \mathbb{R}^2 \to \mathbb{R}^2$ be a linear transformation and $T(1,0) = (2,-1)$ and $T(0,1) = (1,1)$. Then the image of $(1,3)$ is _____ and the preimage of $(0,4)$ is _____. **Ans: $T(1,3) = (5,2)$ and preimage of $(0,4) = \left(-\frac{4}{3}, \frac{8}{3}\right)$**	2	2	2
6	The Reflection matrix about the line $y = -x$ is _____. **Ans: $\begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}$**	1	1	2
7	The projection of the vector $(2,-4,4)^T$ onto the vector $(2,-1,1)^T$ is _____. **Ans: $(4,-2,2)^T$**	1	1	2
8	The nullity of a 3×5 matrix (Tick the correct option) (i) Can be any number from zero to two. **(ii) Can be any number from two to five.** (iii) Must be zero. (iv) Is three. (v) Can be any number from zero to five. (vi) Can be any number from zero to three. (vii) Must be two.	1	1	1

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Sl. No.	**Questions**	M	BTL	CO
1	An underground mine has 5 pumps installed for pumping out storm water, the probability of any one of the pumps failing during the storm is 0.125. Using binomial distribution, the probability that at least 2 pumps will be working is _____. **Ans: 0.9989**	1	2	2
2	Suppose the life expectancy X (in hours) of a transistor tube is exponential distributed with mean life 180. Then the probability that the tube will last between 36 and 90 hours is _____. **Ans: 0.2122**	1	2	2
3	The average waiting time to be seated for dinner at a popular restaurant is 23.5 minutes, with a standard deviation of 3.6 minutes. Assume the variable is normally distributed. When a patron arrives at the restaurant for dinner, the probability that the patron will have to wait between 14 and 21 minutes is _____. **Ans: 0.2395**	2	2	2
4	If $f(x,y) = \begin{cases} m(4-x-y), 0<x<1,\ 0<y<2 \\ 0, \quad otherwise \end{cases}$ is a joint probability density function, then the constant m is _____. **Ans: $m = 0.2$**	1	1	1
5	Let $T: \mathbb{R}^2 \to \mathbb{R}^2$ be a linear transformation and $T(1,0) = (2,3)$ and $T(0,1) = (3,0)$. Then the image of $(1,2)$ is _____ and the preimage of $(-5,0)$ is _____. **Ans: $T(1,2) = (8,3)$ and preimage of $(-5,0) = \left(0, -\frac{5}{3}\right)$.**	2	2	2
6	The Rotation matrix through an angle of 30° in clockwise direction is _____. **Ans:** $\begin{bmatrix} \sqrt{3}/2 & 1/2 \\ -1/2 & \sqrt{3}/2 \end{bmatrix}$	1	1	2
7	The projection of the vector $(-2,12,2)^T$ onto the vector $(1,2,1)^T$ is _____. **Ans: $(4,8,4)^T$**	1	1	2
8	Consider a matrix $B = \begin{bmatrix} 2 & 4 & 0 \\ 4 & 8 & 0 \\ 3 & 6 & 1 \end{bmatrix}$. The dimension of the nullspace of B is _____. **Ans: 1**	1	1	1

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Sl. No.	**Questions**	M	BTL	CO
1	The probability that a bomb dropped from a plane will strike the target is 0.2. If six bombs are dropped, using binomial distribution, the probability that at least two will strike the target is _____. **Ans: 0.3446**	1	2	2
2	Suppose the lifetime X (in days) of a certain component C is exponentially distributed with mean life 120. Then the probability that C will last less than 24 days is _____. **Ans: 0.1812**	1	2	2
3	A sample of 100 dry battery cells produced by a certain company were tested for their length of life, and the test yielded the mean life as 12 hours, standard deviation as 3 hours. Using normal distribution, the probability that a dry battery selected at random will have life lengths between 10 and 14 hours is _____. **Ans: 0.4950**	2	2	2
4	If $f(x,y)=\begin{cases}\frac{6-x-y}{24}, 0<x<2,\ 0<y<4\\ 0, \quad otherwise\end{cases}$ is a joint probability density function, then $P(x<1, y<2)$ is _____. **Ans: 0.375**	1	1	1
5	Let $T:\mathbb{R}^2\to\mathbb{R}^2$ be a linear transformation and $T(1,0)=(4,3)$ and $T(0,1)=(6,2)$. Then the image of $(2,-1)$ is _____ and the preimage of $(0,-4)$ is _____. **Ans: $T(2,-1)=(2,4)$ and preimage of $(0,-4)=\left(-\frac{12}{5},\frac{8}{5}\right)$.**	2	2	2
6	The Reflection matrix about the line $y=x$ is _____. **Ans:** $\begin{bmatrix}0 & 1\\ 1 & 0\end{bmatrix}$	1	1	2
7	The projection of the vector $(2,6,4)^T$ onto the vector $(2,1,2)^T$ is _____. **Ans: $(4,2,4)^T$**	1	1	2
8	Consider a matrix $A=\begin{bmatrix}1 & 4 & 0\\ 4 & 8 & 6\\ 2 & 6 & 6\end{bmatrix}$.The dimension of the nullspace of A is _____. **Ans: 0**	1	1	1