VIT

Vellore Institute of Technology

## School of Advanced Sciences

**Fall Semester 2024-2025**

**Continuous Assessment Test – I**

**Programme Name & Branch: M.Sc (Integrated)**

**Slot: G1+TG1**

**Course Name & Code: Probability and Statistics [ TMAT201L ]**

**Class Number (s): VL2024250104570 / 8065 / 4161**

**Faculty Name (s): Dr. Rajesh Moharana / Dr. Nalliah M / Dr. Jitendra Kumar**

**Exam Duration: 90 Min.** **Maximum Marks: 50**

**General instruction(s): (i) Answer all questions.**

**(ii) Allow use of non-programmable calculator.**

| Q.No. | Question | Max Marks |
|---|---|---|
| 1. | (i) Suppose that we have a fuse box containing 20 fuses, of which 5 are defective. If 2 fuses are selected at random and removed from the box in succession without replacing the first, what is the probability that both fuses are defective?<br><br>(ii) A die is loaded in such a way that an even number is twice as likely to occur as an odd number. If E is the event that a number less than 4 occurs on a single toss of the die, find P(E). | 10 |
| 2. | In a certain assembly plant, three machines, B1, B2, and B3, make 30%, 45%, and 25%, respectively, of the products. It is known from past experience that 2%, 3%, and 2% of the products made by each machine, respectively, are defective. Now, suppose that a finished product is randomly selected, what is the probability that it is defective? If a product was chosen randomly and found to be defective, what is the probability that it was made by machine B3? | 10 |
| 3. | A random variable $X$ has the following probability distribution function:<br><br>$x$ \| 0 \| 1 \| 2 \| 3 \| 4 \| 5 \| 6 \| 7 \| 8<br>$P(X=x)$ \| a \| $3a$ \| $5a$ \| $7a$ \| $9a$ \| $11a$ \| $13a$ \| $15a$ \| $17a$<br><br>(i) Determine the value of "$a$".<br>(ii) Find $P(2 \leq X \leq 5)$ and $P(X < 3)$.<br>(iii) Obtain the cumulative distribution function of $X$. | 10 |

| | | |
|---|---|---|
| 4. | (i) Suppose that $X$ and $Y$ have the following joint probability distribution:<br><br>$f(x,y)$ \| $y$ \| $x$ = 2 \| $x$ = 4<br>$y$ = 1 \| 0.10 \| 0.15<br>$y$ = 3 \| 0.20 \| 0.30<br>$y$ = 5 \| 0.10 \| 0.15<br><br>Find the marginal distribution of X and it's mean $E(X)$.<br><br>(ii) The joint density for the random variables $(X,Y)$ where $X$ is the temperature change and $Y$ is the proportion of the spectrum that shifts for a certain atomic particle is<br><br>$$f(x,y) = \begin{cases} 10xy^2, & 0 < x < y < 1, \\ 0, & elsewhere. \end{cases}$$<br>Find the marginal density functions of $X$ and $Y$. Also, obtain the condition density function of $Y\|X$, that is, $f(y\|x)$. | 10 |
| 5. | The following data were obtained in a study of the relationship between the weight and chest size of infants at birth<br><br>Weight (in kg) \| Chest Size (in cm)<br>2.75 \| 29.5<br>2.15 \| 26.3<br>4.41 \| 32.2<br>5.52 \| 36.5<br>3.21 \| 27.2<br>4.32 \| 27.7<br>2.31 \| 28.3<br>4.30 \| 30.3<br>3.71 \| 28.7<br><br>Calculate the coefficient of correlation for weight and chest size data. Also, give suitable comment on your findings. | 10 |

***** All The Best *****