**B. Tech 2nd Semester Mid-Term Examination, 2024 (2023 Batch)**
**Mathematics-II**
**(INFORMATION TECHNOLOGY)**

Time: 2 hours                                                                 Full Marks: 20

Answer **any four** questions. All questions carry equal marks.

1. (a) A purse contains 2 silver and 4 copper coins and a second purse contains 4 silver and 4 copper coins. If a coin is selected at random from one of the two purse, what is the probability that it is a silver coin ?                                          (2.5)

   (b) Given :                                                                                    (2.5)

   $P(A) = \frac{1}{4}, P(B) = \frac{1}{3}$ and $P(A \cup B) = \frac{1}{2}$, evaluate $P\left(\frac{A}{B}\right), P\left(\frac{B}{A}\right), P(A \cap B')$ and $P\left(\frac{A}{B'}\right)$.

2. (a) For a distribution, the mean is 10, variance is 16, $\gamma_1$ is $+1$ and $\beta_2$ is 4. Obtain the first four moments about the origin, i.e., zero. Comment upon the nature of distribution.        (2.5)

   (b) A coin is tossed until a head appears. What is the ~~expectation~~ *mean* of the number of tosses required ?                                                                    (2.5)

3. A continuous random variable has probability density function as $f(x) = \begin{cases} 3x^2, & 0 < x < 1 \\ 0, & elsewhere \end{cases}$

   (a) Check whether this is a probability density function.

   (b) Find the mean and variance of X.

   (c) Find $P(x < 0 \cdot 3)$ and $P\left(\frac{x > 0.75}{x > 0.50}\right)$                                    (1+2+2 =5)

4. (a) Find the mean and variance of Binomial distribution.                                (2)

   (b) The lines of regression for a bivariate population are $Y = X$ and $4X - Y = 3$, and that the Second moment of X about the origin is 2. Find

   (i) the correlation coefficient (r)

   (ii) the standard deviation of Y                                                              (3)

5. (a) If X and Y are independent Poisson variates such that $P(X=1) = P(X=2)$ and $P(Y=2) = P(Y=3)$. Find the variance of X-2Y.                                          (3)

   (b) If X is a gamma variate with one parameter $\lambda > 0$, find its M.G.F.          (2)

6. (a) In a normal distribution, 7% of the items are under 35 and 89% are under 63.

What are the mean and standard deviation of the distribution. (3)

(b) The means of two single large samples of 1000 and 2000 members are 67.5 inches (2)

and 68 inches respectively. Can the samples be regarded as drawn from the same

population of standard deviation 2.5 inches ?