BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BTECH **SEMESTER : III**
BRANCH: ECE **SESSION : MO/2023**

SUBJECT: EC213 PROBABILITY & RANDOM PROCESS

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	A train and a bus arrive at the station at random between 9 A.M. and 10 A.M. The train stops for 10 minutes and the bus for x minutes. Assuming the train and bus arrive independently, determine the value of x so that the probability that the bus and the train will meet equals 0.5.	[5]	1	V
Q.1(b)	A problem is given to 5 people A, B, C, D, E. If the probability of solving the problem individually is 1/6, 1/5, 2/3, 1/3, 1/2 respectively, then find the probability that the problem is solved.	[5]	1	I
Q.2(a)	Consider the experiment of tossing four coins. The random variable X is associated with the number of trails showing. Compute and sketch the cumulative distribution function and probability density function of random variable X.	[5]	2	III
Q.2(b)	Determine the 4th moment of the random variable $X \sim N(0, \sigma^2)$.	[5]	2	V
Q.3(a)	Let $f_{XY}(x,y) = \begin{cases} 1 & 0 < \lvert y \rvert < x < 1 \\ 0 & otherwise \end{cases}$. Determine $E(X/Y)$.	[5]	3	V
Q.3(b)	Let X and Y be independent exponential random variables with common parameter λ. Define $U = X + Y$ and $V = X - Y$. Find the joint and marginal probability density functions of U and V.	[5]	3	I
Q.4(a)	State and prove the Chernoff bounds.	[5]	4	I
Q.4(b)	Suppose a fair coin is flipped 100 times. Find a bound on the probability that the number of times the coin lands is at least 60 or at most 40.	[5]	4	I
Q.5(a)	A stationary process $x(t)$ with autocorrelation $R_{xx}(t_1, t_2) = q\delta(t_1 - t_2)$ is applied at $t = 0$ to a linear system with impulse response $h(t) = e^{-at}U(t)$. Determine the autocorrelation, $R_{yy}(t_1, t_2)$ of the resulting output y(t).	[5]	5	V
Q.5(b)	Suppose that X(t) is a process with mean, $\eta(t) = 3t$ and autocorrelation, $R(t_1, t_2) = 9 + 4e^{-0.2\lvert t_1 - t_2 \rvert}$. Determine the variance and the covariance of the random variables $Z = X(5)$ and W$= X(8)$.	[5]	5	V

::::::29/11/2023::::::E