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

CLASS: IMSC **SEMESTER : V**
BRANCH: PHY/CHEM/MATH **SESSION : MO/2022**

SUBJECT: MA301 PROBABILITY AND STATISTICS

TIME: 3:00 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.

Q.1(a)	Mention the two important conditions under which the result E(X+Y)=E(X)+E(Y) holds where E denotes mathematical expectation.	[2]	CO=1	BT=1.12
Q.1(b)	How will you interpret P(A)=0, P(A)=1 and 0<P(A)<1?	[3]	CO=1	BT=1.10
Q.1(c)	If A, B and C are mutually independent events, prove that (AUB) and C are also independent.	[5]	CO=1	BT=1.25
Q.2(a)	Why is Binomial distribution so called?	[2]	CO=2	BT=1.10
Q.2(b)	If X and Y are two Poisson variates such that P(X=1)=P(X=2) and P(Y=2)=P(Y=3). Find the coefficient of variation of X and Y.	[3]	CO=2	BT=1.25
Q.2(c)	The fourth order central moment of a normal variate X is 75. Y is an independent standard normal variate. Find the variance of 6X+3Y.	[5]	CO=2	BT=1.25
Q.3(a)	Why is Student's t distribution called an exact sampling distribution?	[2]	CO=3	BT=1.12
Q.3(b)	Explain the concept of joint distribution, marginal distribution and conditional distribution.	[3]	CO=3	BT=1.10
Q.3(c)	Given the joint density f(x,y) = ¼ (1 + xy), -1<x<1, -1<y<1, find the marginal densities of X and Y. Are X and Y independent?	[5]	CO=3	BT=1.25
Q.4(a)	Explain the terms estimation, estimator and estimate.	[2]	CO=4	BT=1.11
Q.4(b)	What is an unbiased estimator? Let X_1, X_2 and X_3 be a random sample from a Normal population with unknown mean μ. Consider an estimator T for μ defined as $T = (2X_1 + X_2 + \lambda X_3)/3$. Find λ so that T becomes an unbiased estimator for μ.	[3]	CO=4	BT=1.25
Q.4(c)	When is an estimator called sufficient? Obtain the sufficient estimator for the mean of Poisson distribution.	[5]	CO=4	BT=1.25
Q.5(a)	What are type I and type II errors in test of significance?	[2]	CO=5	BT=1.11
Q.5(b)	A die is thrown 60 times and an odd prime is observed 25 times. Is the die fair? Test at 5% level of significance.	[3]	CO=5	BT=1.25
Q.5(c)	A random sample of 16 values from a normal population showed a mean of 41.5 inches and the sum of squares of deviations from this mean equals 135 square inches. Is it reasonable to assume the population mean to be 43.5 inches? Test at 5% level of significance (Table t at 5% level and 15 d.f. = 2.131)	[5]	CO=5	BT=1.25

:::::24/11/2022:::::M