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Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree Examination, March 2021

First Degree Programme Under CBCSS

Statistics

Complementary Course for Physics

ST 1331.2 – PROBABILITY DISTRIBUTIONS AND STOCHASTIC PROCESS

(2019 Admission-Regular)

Time : 3 Hours Max. Marks : 80

Use of Calculator and statistical Tables are permitted.

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. Define a discrete uniform distribution.

2. Give a characterization property of the Poisson distribution.

3. Write the mean and variance of the Negative Binomial distribution.

4. What is the distribution of the sample mean when a random sample of size 25 is taken from a Normal population with mean 10 and variance 100.

5. Name the distributions (both discrete and continuous) having the lack of memory property.

6. Which continuous distribution has the maximum entropy?

7. Define a parameter with an example.

P.T.O.

8. What is the distribution of the sample variance when the parent population is Normal?

9. What is combinatorial Analysis?

10. Define a random walk.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. Establish the moment generating function of a Binomial distribution.

12. Find the mode of the distribution with pdf $f(x)=\left(\frac{1}{2}\right)^x, x=1,2,3....$

13. Write the conditions under which a Binomial distribution tends to Poisson distribution.

14. Give some applications of the Poisson distribution.

15. Why the Normal distribution is also known as the Gaussian law of errors?

16. Explain the need of the standard Normal curve instead of having several Normal curves.

17. Write the pdf of a Weibull distribution.

18. If the shape parameter of a Gamma distribution is one, what is the resultant distribution?

19. If X has a Beta type I distribution then find the distribution of $Y=\frac{X}{1-X}$.

20. Find the value of c, where X is a random variable with pdf $f(x)=\begin{cases} cx, 1\le x\le 2 \\ c, 2\le x\le 3 \end{cases}$.

21. Define an F statistic.

22. Give some applications of the Students t distribution.

23. Distinguish between standard error and standard deviation.

24. State the Central Limit Theorem.

25. What is a Fermi-Dirac function?

26. Define a Markov chain.

($8 \times 2 = 16$ Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

27. If X is a Poisson Random variable such that $P(X=1)=P(X=2)$, the find $P(X=4)$.

28. State and prove the additive property of the Binomial distribution.

29. Find the characteristic function for the Geometric distribution and establish that the variance is greater than the mean for it.

30. Find the mean deviation about mean of a continuous rectangular (Uniform) distribution in the interval (a, b).

31. Find the distribution function of an exponential distribution with parameter θ.

32. If X has a Weibull distribution with shape parameter c, then find the distribution of $Y = X^c$.

33. Find the rth raw moment of a Beta type I distribution. Hence find its mean and variance.

34. If $n_1 = n_2$, in an F distribution, then find its median.

35. Establish the inter relations among the Normal, χ^2, F and t distributions.

36. Explain the Maxwell-Boltzmann distribution and the Bose-Einstein distribution.

37. Define a Poisson process, clearly stating its postulates.

38. What is a Transition Probability Matrix of a Markov chain? What is its use?

($6 \times 4 = 24$ Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

39. If X is a Poisson variate with parameter λ and μ_r is the rth central moment, then prove that $\lambda\left\{\binom{r}{1}\mu_{r-1}+\binom{r}{2}\mu_{r-2}+\ldots+\binom{r}{r}\mu_0\right\}=\mu_{r+1}$.

40. The screws produced by a machine were checked by examining sets of 12 screws. The following table shows the distribution of 128 samples according to the number of defective items they contained.

No. of defectives in a set of 12 :	0	1	2	3	4	5	6	7	Total
No. of stets :	7	6	19	35	30	23	7	1	128

Fit a Binomial distribution and find the expected frequencies if the chance of a screw being defective is ½.

41. The random variable X is having a Normal distribution with mean 30 and S.D 5. Find the probability that (i) $26 \le X \le 40$, (ii) $X \ge 45$ and (iii) $|X-30|>5$.

42. Establish the relationship between Q.D, M.D and S.D for a Normal distribution.

43. Find the moment generating function of a χ^2 random variable and obtain its mean and variance. Identify it with the moment generating function of a Gamma variable and hence deduce that it is a special case of the Gamma..

44. Define Stochastic Processes and discuss the various classifications of Stochastic Processes with appropriate examples.

(2 × 15 = 30 Marks)