A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 93025

B.E./B.Tech. DEGREE EXAMINATION, NOV 2022

Third Semester

Civil Engineering

19UMA325- Probability, Statistics and Transform Techniques

(Regulation 2019)

Duration: Three hours Maximum: 100 Marks

Answer All Questions

PART A - (10x 1 = 10 Marks)

1. If X is the discrete random variable having the probability density function, then Calculate k. CO1-App

X	-1	0	1
P(X)	k	2k	3k

(a) 1/6 (b) -1/6 (c) -1 (d) 1

2. A random variable X follows an exponential distribution with parameter $\lambda = 1/5$ then find the mean value . CO6- App

(a) 1/4 (b) 1/2 (c) 3/4 (d) 1

3. If $S_1^2 = 3.761$ and $S_2^2 = 5.249$ then value of F- ratio is CO2- App

(a) 0.717 (b) 1.396 (c) 9.010 (d) 1.488

4. For a sample of size n= 25, the degrees of freedom for the sample size is CO6- App

(a) 24 (b) 22 (c)20 (d) 25

5. If a function f(x) is even, its Fourier expansion contains only ------- terms CO6- App

(a) Sine (b) Cosine (c) tan (d) None of these

6. If $f(x + t) = f(x)$, then f(x) is said to be an _____ CO6- App

(a) Odd Function (b) Even Function (c) Periodic function (d) Self Reciprocal

7. If F[f(x)] = f(s) then the function is said to be _____ CO6- App

(a) Odd (b) Even (c) Self Reciprocal (d) Periodic

8. If $F[f(x)] = f(s)$ thenF[f(ax)] = _____ CO4- App

(a) $\frac{1}{-a}F\left(\frac{s}{a}\right)$ (b) $\frac{1}{a}F\left(\frac{s}{a}\right)$ (c) $\frac{\mathbf{1}}{|\mathbf{a}|}\mathbf{F}\left(\frac{\mathbf{s}}{\mathbf{a}}\right)$ (d) $\frac{1}{s}F\left(\frac{s}{a}\right)$

9. The Z transform of a unit step function is _____. CO6- App

(a) $\log(\frac{z}{z+1})$ (b)$\frac{z}{z+1}$ (c) $\log(\frac{z}{z-1})$ (d)$\frac{z}{z-1}$

10. $Z^{-1}\left(\frac{z}{z-a}\right)$ CO5- App

(a) $(-a)^n$ (b) a^n (c) z^n (d) $(-z)^n$

PART – B (5 x 2= 10Marks)

11. The mean and standard deviation of the binomial distribution are20 and 4 respectively, then calculate the value of the parameter n. CO1- App

12. If A,B are two independent attributes and if (A) = 36, (B) = 25 and N = 100 then find (AB). CO2- App

13. Find b_n in the Fourier series of $f(x) = |\cos x|$ in $(0,2\pi)$ CO3-U

14. State First shifting theorem on Fourier Transforms. CO6- U

15. State Initial and final value Theorem on Z Transform CO6- U

PART – C (5 x 16= 80Marks)

16. (a) A RV X has the following distribution CO1- App (16)

x	0	1	2	3	4	5	6	7	8
P(X)	a	3a	5a	7a	9a	11a	13a	15a	17a

(i) Calculate the value of 'a'

(ii) Calculate $P(X < 3)$, $P(X \geq 3)$ & $P(1 < X < 5)$

(iii) Calculate the cumulative function of X

Or

(b) (i) Find the mgf of the random variable X whose probability density function is given by $f(x) = 2e^{-2x}; x \geq 0$ .and hence find it's mean and variance. CO1 - Ana (8)

(ii) A random variable X has density function given by CO1 -Ana (8)

$$f(x) = \begin{cases} \frac{1}{k}, & for\ 0 < x < k \\ 0, & otherwise \end{cases}$$

Find (i). M.G.F (ii) Mean (iii) Variance

17. (a) (i) The following data are collected on two characters. CO2 -Ana (8)

	Smokers	Non Smokers
Literates	83	57
Illiterates	45	68

Using chi-square test to find is there any relation between smoking and literacy

(ii) 1000 students at college level were according to their I.Q and their economic conditions. What conclusion can you draw the following data CO2 -Ana (8)

Economic condition	I.Q level	
	High	Low
Rich	460	140
Poor	240	160

Or

(b) (i) Two horses A and B were tested according to time (in seconds) to run on a particular track with the following results: CO2 -Ana (8)

Horse A	28	30	32	33	33	29	34
Horse B	29	30	30	24	27	29	

Test whether horse A is running faster than B at 5% level.

(ii) The following table gives the values of protein from Kangeyam cow's milk and buffalo's milk. Examine if these difference are significant. CO2 -Ana (8)

Cow's milk	1.90	1.95	2.00	2.02	1.85	1.80
Buffalo's milk	2.12	2.00	2.20	2.45	2.20	2.10

Table value of t at 5% = 2.228

18. (a) (i) Calculate the Fourier series expansion for $f(x) = x + x^2$ in $(-\pi, \pi)$ CO3- App (8)

(ii) Express $f(x) = \frac{1}{2}(\pi - x)$ as Fourier series of period 2π in the interval $0<x<2\pi$ and hence deduce the sum of series $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots\ldots = \frac{\pi}{4}$ CO3- App (8)

Or

(b) (i) Find the Half range cosine series for $f(x) = x(\pi - x)$ in $(0, \pi)$. CO3- App (8)

(ii) Find the Half range Sine Series of $f(x) = x \ in \ (0, \pi)$ CO3- App (8)

19. (a) Show that the Fourier transform of CO4-App (16)

$$f(x) = \begin{cases} a^2 - x^2 & |x| < a \\ 0 & |x| > a \end{cases}$$ is $2\sqrt{\frac{2}{\pi}}\left[\frac{\sin sa - sa\cos sa}{s^3}\right]$ Hence deduce (i) $\int_0^\infty \frac{\sin t - t\cos t}{t^3} dt = \pi/4$ (ii) $\int_0^\infty \left(\frac{\sin t - t\cos t}{t^3}\right)^2 dt = \pi/15$

Or

(b) (i) Evaluate $\int_0^\infty \frac{x^2 dx}{(x^2 + a^2)^2}$ CO4 -App (8)

(ii) Prove that $f(x) = e^{-\frac{x^2}{2}}$ is self-reciprocal under Fourier series Transform CO4 -App (8)

20. (a) (i) Find the $z^{-1}\left[\frac{12z^2}{(3z-1)(4z-1)}\right]$ using convolution theorem CO5- App (8)

(ii) Solve $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ *given* $y_0 = y_1 = 0$ CO5- App (8)

Or

(b) (i) Evaluate $Z[r^n \cos n\theta]$ *and* $Z[r^n \sin n\theta]$ CO5- App (8)

(ii) Using convolution theorem find $z^{-1}\left(\frac{z^2}{(z+1)(z-2)}\right)$ CO5- App (8)