A

Reg. No. :

Question Paper Code: U3025

B.E./B.Tech. DEGREE EXAMINATION, NOV 2023

Third Semester

Civil Engineering

21UMA325- PROBABILITY, STATISTICS AND TRANSFORM TECHNIQUES

(Regulations 2021)

(t,f,x2 table has to be given)

Duration: Three hours   Maximum: 100 Marks

Answer All Questions

PART A - (10x 1 = 10 Marks)

1. The limiting form a Poisson distribution is   CO6 -U

    (a) Geometric   (b) Binomial   (c) Normal   (d) None of the above

2. Which of the following continuous distribution has equal mean and   CO6- U
   variance?

    (a) Exponential   (b) Binomial   (c) Gamma   (d) Normal

3. In Chi-square the sample observations should be   CO6 -U

    (a) dependent   (b) independent   (c) equal   (d) none of these

4. Choose the F-test $(S_2^2 > S_1^2)$ CO6- U

    (a) $F = S_1^2 / S_2^2$ (b) $F = S_2^2 / S_1^2$ (c) $F = 0$ (d) None of the above

5. cos x is a periodic function with period ----------   CO6- U

    (a) π (b) 2π (c) $\pi/3$ (d) $2\pi/3$

6. The Fourier constant b_n in $(-\pi,\pi)$ for x sin x is _____   CO3 -App

    (a) x^2 (b)3x   (c)0   (d) 1

7. $F_s[e^{-ax}] = $ _____   CO6- U

    (a) $\sqrt{\dfrac{2}{\pi}}\dfrac{s}{s^2+a^2}$ (b)$\sqrt{\dfrac{2}{\pi}}\dfrac{a}{s^2+a^2}$ (c)$\sqrt{\dfrac{2}{\pi}}\dfrac{a^2}{s^2+a^2}$ (d)$\sqrt{\dfrac{2}{\pi}}\dfrac{s^2}{s^2+a^2}$

8. If f(x) = x find the constant coefficients a_0 CO6- U

   (a) 0   (b) $\frac{1}{2}\int_0^a f(x)dx$ (c) $2\int_0^a f(x)dx$ (d) $\int_0^a f(x)dx$

9. The Z transform of $n2^n$ is ____   CO5- App

   (a) $\dfrac{2z}{(z-2)^2}$ (b) $\dfrac{z}{(z-2)^2}$ (c) $\dfrac{2z}{(z+2)^2}$ (d) $\dfrac{z}{(z+2)^2}$

10. Evaluate $Z\left(\dfrac{1}{n!}\right)$ CO5- U

   (a) $e^{-1/z}$ (b) $e^{1/z}$ (c) e^{2z} (d) $e^{1/z} - 2$

PART – B (5 x 2= 10Marks)

11. If $f(x) = \begin{cases} Kxe^{-x}, & x > 0 \\ o, & elsewhere \end{cases}$ is the PDF of a RV X, Find K   CO1- App

12. Explain Null Hypothesis   CO2- U

13. Find a_0 and a_n in the Fourier series of f(x) = x in (0,2π).   CO3 -App

14. Write Fourier sine Transform pair   CO6 -U

15. Evaluate $Z(n)$ CO5- App

PART – C (5 x 16= 80Marks)

16. (a)   (i) A RV X has the following distribution   CO1 -App   (8)

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

   (i) Find the value of 'a'

   (ii) Find

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

   (ii) Define Binomial distribution. Find the moment generating   CO1- App   (8)
function and Hence find mean and variance

<div align="center">Or</div>

  (b)   CO1 -App   (8)

   (i) If $f(x) = \begin{cases} \dfrac{k}{1+x^2}, & x > 0 \\ o, & elsewhere \end{cases}$ is the Probability Density Function of

   a Random variable X , (i) Find K   (ii) distribution function of F(x)

   (ii) Define Exponential distribution. State and Prove the memory   CO1 -App   (8)
less property for an exponential distribution

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17. (a) A group of 10 rats fed on diet A and another group of 8 rats fed on diet B, recorded the following increase in weight.   CO2- Ana   (16)

Diet A	5	6	8	1	12	4	3	9	6	10
Diet B	2	3	6	8	10	1	2	8		

Find the variances are significantly different.

Or

(b) Two researchers A and B adopted different techniques while rating the students level. Can you say that the techniques adopted by them are significant?   CO2- Ana   (16)

Researchers	Below Average	Average	Above Average	Genius	Total
A	40	33	25	2	100
B	86	60	44	10	200
Total	126	93	69	12	300

18. (a) The table of values of the function $y = f(x)$ is given below: CO3- App   (16)

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π
y:	1.0	1.4	1.9	1.7	1.5	1.2	1.0

Find a Fourier series upto the third harmonic to represent $f(x)$ in terms of x.

Or

b) (i) Find the Fourier series of $f(x) = x+x^2$ in $(-\pi, \pi)$ of periodicity 2π. Hence deduce that the value of the sum.   CO3 -App   (8)

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

Deduce that $\dfrac{1}{1^4} + \dfrac{1}{2^4} + \dfrac{1}{3^4} \ldots\ldots = \dfrac{\pi^4}{90}$

19. (a) Compute the Fourier Transform of $f(x) = \begin{cases} a - |x| & if\ |x| \le a \\ 0 & if\ |x| > a \end{cases}$ and   CO4 - App   (16)

hence evaluate (i) $\int_0^\infty \left(\dfrac{\sin x}{x}\right)^4 dx$ (ii) $\int_0^\infty \left(\dfrac{\sin x}{x}\right)^2 dx$

Or

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(b)   Evaluate (i) $\int_0^\infty \frac{dx}{(x^2+16)^2}$ (ii) $\int_0^\infty \frac{dx}{(x^2+49)^2}$ using Fourier transform   CO4 -App   (16)

20. (a)   (i) Solve   the difference equation $y_{n+2} - 6y_{n+1} + 8y_n = 5^n$ given   CO5 -App   (8)
that $y_0 = 0$, $y_1 = 0$

(ii) Using Convolution theorem find   CO5 -App   (8)

$$Z^{-1}\left[\frac{10z^2}{(5z-2)(2z+1)}\right]$$

Or

(b)   (i) Solve   the difference equation $y_{n+2} + 3y_{n+1} - 10y_n = 3^n$ given   CO5- App   (8)
that $y_0 = 0$, $y_1 = 0$

(ii) Using Convolution theorem find   CO5 -App   (8)

$$Z^{-1}\left[\frac{14z^2}{(7z+3)(2z-1)}\right]$$

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