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Question Paper Code: 93025

B.E./B.Tech. DEGREE EXAMINATION, MAY 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, CO6-App
then Calculate k .

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 CO6- App
 $\lambda = 1/5$ then find the mean value .
- (a) $1/4$ (b) $1/2$ (c) $3/4$ (d) 1
3. Large sample size is CO6- App
- (a) 30 (b) >30 (c) <30 (d) none of these
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 $F[f(x)] = f(s)$ then $F[f(ax)] =$ _____ CO4- App
 (a) $\frac{1}{-a} F\left(\frac{s}{a}\right)$ (b) $\frac{1}{a} F\left(\frac{s}{a}\right)$ (c) $\frac{1}{|a|} F\left(\frac{s}{a}\right)$ (d) $\frac{1}{s} F\left(\frac{s}{a}\right)$
9. The Z transform of a unit step function is _____. CO6- App
 (a) $\log\left(\frac{z}{z+1}\right)$ (b) $\frac{z}{z+1}$ (c) $\log\left(\frac{z}{z-1}\right)$ (d) $\frac{z}{z-1}$
10. The Z transform of $n.a^n$ CO5- App
 (a) $\frac{2z}{(z-2)^2}$ (b) $\frac{z}{(z-2)^2}$ (c) $\frac{az}{(z-a)^2}$ (d) $\frac{z}{(z+2)^2}$

PART – B (5 x 2= 10Marks)

11. A Continuous random variable with density function is given by CO1- App
 $f(x) = 6x(1-x), 0 \leq x \leq 1$ Check the above is PDF or not.
12. If A,B are two independent attributes and if $(A) = 36, (B) = 25$ and $N = 100$ CO2- App
 then find (AB) .
13. Find b_n in the Fourier series of $f(x) = |\cos x|$ in $(0,2\pi)$ CO3-U
14. Find the Fourier sine transform of $\frac{1}{x}$ CO4- App
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 CO1 - Ana (8)
 density function is given by $f(x) = 2e^{-2x}; x \geq 0$.and hence find it's
 mean and variance.
 (ii) A random variable X has density function given by CO1 -Ana (8)

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

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

17. (a) (i) A company keeps records of accidents. During a recent safety review, a random sample of 60 accidents was selected and classified by the day of the week on which they occurred. CO2 -Ana (8)

Days	Mon	Tue	Wed	Thu	Fri
No.of. accidents	8	12	9	14	17

Table value of $\chi^2 = 9.488$

- (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) 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 CO3- App (8)

$$1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots = \frac{\pi}{4}$$

- (ii) Find the Fourier series of $f(x) = x^2$ in $0 < x < 2l$. CO3- App (8)

Or

- (b) (i) Calculate the Fourier series expansion for $f(x) = x + x^2$ in $(-\pi, \pi)$ 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)

$$f(x) = \begin{cases} a^2 - x^2 & |x| < a \\ 0 & |x| > a \end{cases} \text{ is } 2\sqrt{\frac{2}{\pi}} \left[\frac{\sin sa - sa \cos sa}{s^3} \right] \text{ Hence}$$

$$\text{deduce (i) } \int_0^{\infty} \frac{\sin t - t \cos t}{t^3} dt = \pi/4 \quad \text{(ii) } \int_0^{\infty} \left(\frac{\sin t - t \cos t}{t^3} \right)^2 dt = \pi/15$$

Or

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

(ii) Evaluate $\int_0^{\infty} \frac{dx}{(x^2 + 9)(x^2 + 4)}$ CO4 -App (8)

20. (a) (i) Using convolution theorem find CO5- App (8)

$$Z^{-1} \left(\frac{8z^2}{(2z-1)(4z-1)} \right)$$

- (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 $Z^{-1} \left(\frac{z^2}{(z-1)(z-3)} \right)$ CO5- App (8)