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**Question Paper Code: 93021**

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

Third Semester

Mechanical Engineering

19UMA321- Probability, Statistics & Partial Differential Equations

(Regulation 2019)

Duration: Three hours

Maximum: 100 Marks

Answer All Questions

PART A - (10x 1 = 10 Marks)

1. Large sample size is CO6- U  
(a) 30                      (b) >30                      (c) <30                      (d) none of these
2. Chi-square test is very popularly known as a test of CO6- U  
(a) Independent of attributes                      (b) t- test  
(c) F-test                      (d) goodness of fit
3. If F Latin square design is a \_\_\_\_\_ CO6- U  
(a) One way                      (b) Two way                      (c) Three way                      (d) None of these
4. Choose the correction factor \_\_\_\_\_ CO6- U  
(a)  $T^2N^2$                       (b)  $T/N$                       (c)  $T^2/N$                       (d) 0
5. The limiting form a Binomial distribution is CO6- U  
(a) Geometric                      (b) Poisson                      (c) Normal                      (d) None of the above
6. For a binomial distribution mean is 6 and S.D is  $\sqrt{2}$  then P CO3- App  
is \_\_\_\_  
(a)  $\frac{2}{3}$                       (b)  $\frac{1}{3}$                       (c)  $\frac{5}{3}$                       (d)  $\frac{2}{5}$
7. The PDE obtained from  $z = (x+a)(y+b)$  is \_\_\_\_ CO4- App  
(a)  $3z = px + qy$                       (b)  $py - qx = 0$                       (c)  $3z = px + qy$                       (d)  $py - qx = 0$

8. The particular integral of  $(D^2 - 4DD' + 3D'^2)z = e^{x+y}$  is \_\_\_\_\_ CO4- App
- (a)  $\frac{xe^{x+y}}{2}$  (b)  $\frac{xe^{x+y}}{2}$  (c)  $\frac{xe^{x+y}}{2}$  (d)  $\frac{xe^{x+y}}{2}$
9. An insulated rod of length 60 cm has its ends at A and B kept at 20°C and 80°C respectively, then its steady state solution is CO6- U
- (a)  $x-20$  (b)  $4x+20$  (c)  $x+20$  (d)  $x+60$
10.  $Au_{xx} + Bu_{xy} + Cu_{yy} = f(x, y)$  is parabolic if \_\_\_\_\_. CO5- U
- (a)  $B^2 - 4AC < 0$  (b)  $B^2 - 4AC = 0$  (c)  $B^2 - 4AC > 0$  (d)  $B^2 - 4AC \neq 0$

PART – B (5 x 2= 10Marks)

11. Explain Null Hypothesis. CO1- App
12. Why a 2\*2 Latin square is not possible? Explain CO2- App
13. If a random variable has the moment generating function given by CO3- App
- $$M_x(t) = \frac{2}{2-t}, \text{ determine the variance of X}$$
14. Find the complete integral of  $p - q = 1$  CO4- App
15. Solve  $(D^2 - 2DD' + 2D'^2)Z = 0$  CO5- App

PART – C (5 x 16= 80Marks)

16. (a) (i) A group of 10 rats fed on a diet A and another group of 8 rats fed on diet B recorded the following increase in weights. CO1-Ana (8)

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

Find if the variances are significantly difference.

- (ii) Two horses A and B were tested according to time (in seconds) to run on a particular track with the following results: CO1-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 using t-test

Or

- (b) (i) The table gives the number of aircraft accidents that occurred during the various days of the week. Test whether the accidents are uniformly distributed over the week. CO1 -Ana (8)

Days	Mon	Tue	Wed	Thu	Fri	Sat
No.of. accidents	14	18	12	11	15	14

- (ii) A die is thrown 264 times with the following results. Show that the die is biased CO1 -Ana (8)

No. appeared on the die	1	2	3	4	5	6
Frequency	40	32	28	58	54	52

17. (a) Analyse the following is a Latin square of a design. CO2 -Ana (16)

A 105	B 95	C 125	D 115
C115	D 125	A 105	B 105
D 115	C 95	B 105	A 115
B 95	A 135	D 95	C 115

Or

- (b) The following data represent the number of units of production per day turned out by 5 different workers using 4 different types of machines. Analyse the data CO2 -Ana (16)

	Machine Type				
		A	B	C	D
Workers	1	44	38	47	36
	2	46	40	52	43
	3	34	36	44	32
	4	43	38	46	33
	5	38	42	49	39

18. (a) (i) Find the moment generating function and hence find mean and variance for the Poisson distribution CO3- App (8)
- (ii) Find the moment generating function of the random variable X whose probability function  $P[X = x] = \frac{1}{2^x}; x = 1, 2, 3, \dots$  and hence find its mean and variance. CO3- App (8)

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 its mean and variance. CO3- App (8)
- (ii) The cumulative distribution function of a random variable X is  $F(x) = 1 - (1+x)e^{-x}, x > 0$ . Find the probability density function of X, mean and variance CO3-App (8)

19. (a) (i) Solve  $(D^2 + 2DD^1 - D^1^2)z = \cos(2x - y)$  CO4-App (8)
- (ii) Solve  $(mz - ny)p + (nx - lz)q = ly - mx$  CO4-App (8)

Or

- (b) (i) Solve  $Z = px + qy + p^2 - q^2$  CO4 -App (8)
- (ii) Form a P.D.E by eliminating arbitrary functions from  $z = f\left(\frac{xy}{z}\right)$  CO4 -App (8)

20. (a) A bar of 10cm long with insulated sides has its ends A and B kept at  $20^\circ\text{C}$  and  $40^\circ\text{C}$  respectively. Until steady state condition prevails. The temperature at A is then suddenly raised to  $50^\circ\text{C}$  and at the same instant B is lowered to  $10^\circ\text{C}$  and maintained thereafter. Find the subsequent temperature distribution in the bar. CO5- App (16)

Or

- (b) A String is stretched and fastened to two points  $l$  apart. Motion is started by displacing the string into the form  $y=K(lx-x^2)$  from which it is released at  $t=0$ . Find the displacement of any point at a distance 'x' at any time 't' CO5- App (16)