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**Question Paper Code: U3021**

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

Third Semester

Mechanical Engineering

21UMA321- PROBABILITY, STATISTICS AND PARTIAL DIFFERENTIAL EQUATIONS

(Regulations 2021)

(t,f,x<sup>2</sup> table has to be given)

Duration: Three hours

Maximum: 100 Marks

Answer All Questions

PART A - (10x 1 = 10 Marks)

- The degrees of freedom for chi square tests to fitting a binomial distribution CO6- U  
(a)  $n - 1$                       (b)  $n - 2$                       (c)  $n - 3$                       (d)  $n - 4$
- Small sample size is \_\_\_\_\_ CO6- U  
(a) 30                      (b)  $> 30$                       (c)  $< 30$                       (d) None of these
- What must we include when reporting an ANOVA? CO6 -U  
(a) Standard deviations    (b) Means    (c) Degrees of freedom    (d) All of these
- In factorial experiments..... CO6- U  
(a) Testing one factor at a time                      (b) Cannot estimate interactions  
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- If X is exponentially distributed with parameter 3 then mean value is \_\_\_\_\_ CO3- App  
(a)  $1/3$                       (b) 3                      (c)  $1/9$     (d) None of these
- If X and Y are independent, then  $Cov(X, Y) =$  CO3 -App  
a) 1                      b) 0                      c) 2                      (d) 3
- The PDE obtained from  $z = (x + a)(y + b)$  is \_\_\_\_ CO4- App  
(a)  $3z = px + qy$                       (b)  $z = pq$                       (c)  $3z = px - qy$                       (d)  $py - qx = 0$

8. The PDE of all planes having equal intercepts on the X axis and Y axis is - CO4 -App  
 (a)  $p = q$  (b)  $p + q = 0$  (c)  $p = -2q$  (d)  $p + 3q = 0$
9. A Classify the equation  $u_{xx} + u_{yy} = 0$  is \_\_\_\_ CO6 - U  
 (a) parabolic (b) hyperbolic (c) elliptic (d) cyclic
10. The one dimensional heat equation is \_\_\_\_ CO6 U  
 (a)  $U_{xx} = C^2 U_t$  (b)  $U_{xx} = C^2 U_{tt}$  (c)  $U_{xx} = C U_t$  (d)  $U_x = C U_{tt}$

PART – B (5 x 2= 10Marks)

11. What are null and alternate hypothesis?. CO6- U
12. What is the aim of design of experiments? CO6- U
13. Find the mean for the discrete RV X with probability distribution CO3- App

x	-2	-1	0	1
P(X)	0.2	3k	0.2	0.3

14. Solve:  $(D^3 - 3DD^2 + 2D^3)Z = 0$ . CO4 -App
15. Classify the p.d.e  $3u_{xx} + 4u_{xy} + 3u_y - 2u_x = 0$  CO6- U

PART – C (5 x 16= 80Marks)

16. (a) (i) Two random samples gave the following results: CO1- App (8)

Samples	Size	Sample Mean	Sum of the squares of deviation from the mean
1	10	15	90
2	12	14	108

Examine whether the samples come from the same normal population.

- (ii) Two independent samples of sizes 9 and 7 from a normal population had the following values of the variables. CO1- App (8)

Sample I	18	13	12	15	12	14	16	14	15
Sample II	16	19	13	16	18	13	15	-	-

Do the estimates of the population variance differ significantly at 5% level?

Or

- (b) (i) 4 coins were tossed 160 times and the following results were obtained: CO1- App (8)

No. of heads:	0	1	2	3	4
Observed frequencies:	17	52	54	31	6

Under the assumption that the coins are unbiased, find the expected frequencies of getting 0, 1, 2, 3, 4 heads and test the goodness of fit.

- (ii) Two sample polls of votes for two candidates A and B for a public office are taken one from among residents of rural areas. The results are given below. Examine whether the nature of the area is related to voting preference in this election. CO1- App (8)

Area/Votes for	A	B	Total
Rural	620	380	1000
Urban	550	450	1000
Total	1170	830	2000

17. (a) A company appoints 4 salesmen A, B, C and D and observes their sales in 3 seasons, summer, winter and monsoon. The figures are given in the following table: CO2 -Ana (16)

Salesmen

Season	1	2	3	4
Summer	45	40	28	37
Winter	43	41	45	38
Monsoon	39	39	43	41

Carry out an Analysis of variances.

Or

- (b) In a Latin square experiment, the data collected is given in the matrix below. Yield per plot is given in quintals for the five different cultivation treatments A, B, C, D and E. Analyze the data for variations. CO2- Ana (16)

A48	E66	D56	C52	B61
D64	B62	A50	E64	C63
B69	A53	C60	D61	E67
C57	D58	E67	B65	A55
E67	C57	B66	A60	D57

18. (a) (i) Obtain the Correlation coefficient for the following data CO3- App (8)

X	12	15	17	18	23	16	25	27
Y	110	120	124	130	136	122	140	143

- (ii) Explain the M.G.F of Binomial distribution and hence find mean and variance. CO3- App (8)

Or

- (b) (i) A r.v X has the following probability distribution CO3 -App (8)

X	-2	-1	0	1	2	3
P(x)	0.1	k	0.2	2k	0.3	3k

Find (i) Value of k, (ii) Find  $P(-2 < X < 2)$  and (iii) Find the cumulative distribution of X.

- (ii) A RV X has the following distribution CO3 -App (8)

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

(a) Find the distribution function of x

(b) Find  $P(X \geq 3 / X > 7)$

(c) Find Mean

19. (a) (i) Solve  $(D^2 - 5DD' + 6D'^2)z = e^{x+y} + \sin(x - y)$  CO4 -App (8)

(ii) Solve  $x(y - z)p + y(z - x)q = z(x - y)$  CO4 -App (8)

Or

- (b) (i) Solve  $Z = px + qy + p^2 - q^2$  CO4- App (8)

(ii) Form a PDE by eliminating arbitrary functions from CO4- App (8)

$$\varphi(x^2 + y^2 + z^2, x + y + z) = 0$$

20. (a) A bar of 10cm long with insulated sides has its ends A and B kept at  $50^\circ\text{C}$  and  $100^\circ\text{C}$  respectively. Until steady state condition prevails. The temperature at A is then suddenly raised to  $90^\circ\text{C}$  and at the same instant B is lower to  $60^\circ\text{C}$  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 in to the form  $\lambda (lx - x^2)$  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)

