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

Question Paper Code: 93021

B.E./B.Tech. DEGREE EXAMINATION, NOV 2025

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. The degrees of freedom in t-tests is CO6- U

   (a) n-1 (b)n-2 (c) n-3 (d)n-4

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 (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 is___ CO3- App

   (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. Classify the equation $u_{xx}+u_{yy} = 0$ is _____ CO6- U

(a) parabolic (b) hyperbolic (c) elliptic (d) cyclic

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) $B^2-4AC\neq0$

PART – B (5 x 2= 10Marks)

11. Define Chi-square test of goodness of fit. 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 $M_x(t) = \frac{2}{2-t}$, determine the variance of X CO3- App

14. Find the complete integral of $p - q = 1$ CO4- App

15. Classify $8u_{xx} - 5u_{xy} + u_{yy} = 0$ CO5- App

PART – C (5 x 16= 80Marks)

16. (a) (i) The following data are collected on two characters. CO1-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) A company keeps records of accident during a recent safety review , a random sample of 60 accidents was selected and classified by the day of week on which they accured CO1-Ana (8)

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

Test whether there is any evidence that accidents are more likely on some days than others.

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			
Workers	A	B	C	D
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) State and prove memoryless property of exponential distribution. CO3- App (8)

(ii) Find the moment generating function of the random variable X whose probability function $P[X = x] = \frac{1}{2^x}; x = 1,2,3....$ and hence find it's mean and variance. CO3- App (8)

Or

(b) (i) If $f(x) = kx^2 e^{-x}$, $0 < x < \infty$ find the value of K and find mean and Variance of the distribution. 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 $(D^2 - 5DD' + 6D'^2)z = e^{x+y}$ 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 P.D.E by eliminating arbitrary functions from $z = f\left(\frac{xy}{z}\right)$ CO4 -App (8)

20. (a) A bar of 30cm long with insulated sides has its ends A and B kept at 20^o c and 80^oc respectively. Until steady state condition prevails. The temperature at A is then suddenly raised to 60^oc and at the same instant B is lower to 40^oc 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)