Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 10858

M.E./M.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

First Semester

Biometrics and Cyber Security

MA 5160 — APPLIED PROBABILITY AND STATISTICS

(Common to: M.E. Computer Science and Engineering/ M.E. Computer Science and Engineering (With Specialization in Networks)/ M.E. Industrial Engineering/ M.E. Manufacturing Engineering/ M.E. Multimedia Technology/ M.E. Software Engineering/ M.Tech. Information technology)

(Regulation 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the MGF of Poisson distribution.

2. State the Baye's theorem.

3. The joint pdf of random variable X and Y is given by $f(x, y) = kxye^{-(x^2+y^2)}$, $x > 0$, $y > 0$. Find the value of k.

4. The joint pdf of random variable X and Y is given by $f(x, y) = 4xy$, $0 < x < 1$, $0 < y < 1$. Are X and Y independent random variables?

5. Write down the normal equation for the fitting of parabola $y = a + bx + cx^2$.

6. Write down the Fisher's criteria for a good estimator.

7. Define One-Tailed test and Two-Tailed test in sampling theory.

8. Write down the procedure for testing of hypothesis.

9. Define mean vector.

10. Define multivariate normal density function.

PART B — (5 × 13 = 65 marks)

11. (a) A random variable X has the following probability function:

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

(i) Determine the value of a.

(ii) Find $P(X<3), P(X\geq 3)$ and $P(0<X<5)$.

(iii) Find the distribution function of X. (13)

Or

(b) Find the MGF of binomial distribution. Hence find first three moments about the origin, mean and variance. (13)

12. (a) If $f(x, y)=\frac{6-x-y}{8}, 0<x<2, 2<y<4$. Find the correlation co-efficient between X and Y. (13)

Or

(b) Heights of fathers and sons are given in centrimeters: (13)

Height of Father	150	152	155	157	160	161	164	166
Height of Son	154	156	158	159	160	161	164	166

Find the two lines of regression and calculate the expected average height of the son when the height of the father is 154 cm.

13. (a) Fit a parabola of second degree to the following data: (13)

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

Or

(b) On the basis of a random sample find the maximum likelihood estimator of the parameter of a Poisson distribution. (13)

14. (a) (i) The average numbers of articles produced by two machines per day are 200 and 250 with SD 20 and 25 respectively on the basis of records of 25 days production. Can you regard both the machines equally efficient at 1% level of significance [$t_{0.01}$ for 48 df = 2.58]. (7)

(ii) A sample of size 13 gave an estimated population variance 3.0, while another sample of size 15 gave an estimate of 2.5 could both samples be from populations with the same variance. [$F_{0.05}$ (12, 14) df = 2.53] (6)

Or

(b) (i) A die is thrown 264 times with the following results. Show that the die is biased. [$\psi^2_{0.05}$ for 5 df = 11.07]. (7)

Face number appeared on the die	1	2	3	4	4	6
Frequency	40	32	28	58	54	52

(ii) In a big city 325 men out of 600 men were found to be smokers. Does this information support the conclusion that the majority of men in this city are smokers? (6)

15. (a) Find the mean and covariance matrix for the random vector $X'=[X_1, X_2]$, where X_1 and X_2 are $P_{12}(X_1, X_2)$ is given by (13)

X_1/X_2	0	1
−1	.24	.06
0	.16	.14
1	.40	.00

Or

(b) If the random variables X_1, X_2 and X_3 have the covariance matrix $\Sigma=\begin{pmatrix}1 & -2 & 0\\ -2 & 5 & 0\\ 0 & 0 & 2\end{pmatrix}$ then find the principal components. (13)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Find the mean and variance of Uniform distribution defined in the interval (a, b). (7)

(ii) Find the MGF of the exponential distribution and hence find the mean Δ variance. (8)

Or

(b) (i) Find the marginal density function of X and Y, if $f(x, y)=\frac{2}{5}(2x+5y),\ 0<(x, y)<1$. (6)

(ii) By the method of least squares find the best fitting straight line to the data given below: (9)

x	5	10	15	20	25
y	16	19	23	26	30