



R20 Regulation

Subject code:3H4GA

# TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

## B.Tech IV Semester Supplementary Examinations, December 2025

### PROBABILITY & ALGEBRA (Common to CSE(AI&ML) & CSE(DS))

Maximum Marks: 70

Date: 16.12.2025

Duration: 3 hours

- Note:**
1. This question paper contains two parts A and B.
  2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
  3. Part B consists of 5 Units. Answer any one full question from each unit.
  4. Each question carries 10 marks and may have a, b, c, d as sub questions.

#### Part-A

All the following questions carry equal marks (10X2M=20 Marks)		Marks	CO	BTL
1	Define i) Equally likely events ii) Mutually exclusive events	2M	1	L1
2	If A & B are any two events and $A \subset B$ then prove that $P(A) \leq P(B)$	2M	1	L1
3	Define joint probability distribution functions of two-dimensional random variables	2M	2	L1
4	Define conditional probability functions of two-dimensional random variables X and Y.	2M	2	L1
5	The mean and variance of a binomial distribution are 4 & 3 respectively find the mode of the binomial distribution	2M	3	L1
6	If X is a normal variate, z is a standard normal variate then find the area to the left of $z = 1.78$	2M	3	L1
7	Write the rules to draw the Hasse diagram of a Poset	2M	4	L1
8	Consider the function $f:R$ to $R$ defined by $f(x)=2x+5$ , another function $g(x)=(x-5)/2$ . Prove that $g$ is inverse of $f$ .	2M	4	L1
9	Show that the cube roots of unity form a group with respect to multiplication.	2M	5	L1
10	Define Left coset of subgroup H in G.	2M	5	L1

#### Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
11	a) State and prove addition theorem for two events	5M	1	L2
	b) A, B, C are aiming to shoot a balloon. A will succeed 4 times out of 5 attempts. The chance of B to shoot the balloon is 3 out of 4 and that of C is 2 out of 3. If the three aim the balloon simultaneously then find the probability that at least two of them hit the balloon.	5M		
OR				
12	a) Two aero planes bomb a target in succession. The probability of each correctly scoring a hit is 0.3 and 0.2 respectively. The second will bomb only if the first misses the target. Find the probability that i) target is hit ii) both fails to score hits	5M	1	L2
	b) A product is assembled from 3 components X, Y, Z. the probability of these components being defective is 0.01, 0.02, 0.05 respectively. What is the probability that the assembled product will not be defective?	5M		

13	A continuous random variable has the probability function $f(x) = \begin{cases} K x e^{-\lambda x} & \text{for } x \geq 0, \lambda > 0 \\ 0 & \text{otherwise} \end{cases}$ Determine (i) k (ii) Mean (iii) Variance	10M	2	L2
OR				
14	Two balls are drawn at random from a box containing 3 red, 2 green and 4 white balls, if X and Y are the random variables representing the number of red balls and green balls respectively including among the two balls drawn from the box, find i) joint probability of X & Y    ii) marginal probability of X & Y iii) conditional distribution of X given Y=1.	10M	2	L2
15	a) It has been found that 2% of the tools produced by a certain machine are defective what is the probability that in a shipment of 400 such tools i) 3% of more    (ii) 2% or less will prove defective. b) In a binomial distribution consisting of 5 independent trials, probabilities of 1 and 2 success are 0.4096 and 0.2048 respectively. Find the parameter 'p' of the distribution.	5M  5M	3	L2
OR				
16	a) In normal distribution 31% of the items are under 45 and 8% are over 64. Find mean and variance of the distribution. b) Write the chief characteristics of Normal distribution.	10M	3	L2
17	a) Show that the relation $R = \{ (a,a), (a,b), (b,a), (b,b), (c,c) \}$ on $A = \{a,b,c\}$ is an equivalence relation and find $A/R$ also find partitions of A. b) Let $f: R \rightarrow R$ , $g: R \rightarrow R$ , where R is the set of real numbers be given by $f(x) = x^2 - 2$ and $g(x) = x+4$ find $f \circ g$ and $g \circ f$ . state whether these functions are bijective or not.	5M  5M	4	L2
OR				
18	a) Prove that the relation R defined by "a is congruent to b modulo m" on the set of integers is an equivalence relation. b) Draw the Hasse diagram representing the positive divisors of 45.	5M  5M	4	L2
19	a) Prove that set of non-singular matrices of order $2 \times 2$ is a group but not an abelian group under multiplication. b) If 'G' is a group then prove that $(a^{-1})^{-1} = a$	5M  5M	5	L2
OR				
20	a) Prove that $G = \{0,1,2,3,4,5,6\}$ is an abelian group of order 7 with respect to addition modulo 7. b) Define subgroup, normal subgroup, Quotient group, left and right cosets with an example for each.	5M  5M	5	L2