



QP CODE: 26802018



26802018

Reg No :

Name :

INTEGRATED M Sc DEGREE EXAMINATION APRIL 2026

Second Semester

INTEGRATED M Sc BASIC SCIENCES - STATISTICS

CORE - IST2CR03 - AN INTRODUCTION TO PROBABILITY THEORY

2020 Admission Onwards

A0E675EE

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

Answer any **eight** questions.

Weight 1 each.

1. What is sample space? Which are the different types of sample space?
2. What are mutually exclusive events. Give an example
3. What is the probability that a normal year contains 53 Wednesdays?
4. Are mutually exclusive events and independent events the same? Justify your answer.
5. Define prior and posterior probabilities.
6. What you mean by discrete and continuous random variables?
7. A random variable X has the probability function $f(x) = \frac{x}{21}$, $x = 1, 2, 3, 4, 5, 6$. Find the distribution function of X .
8. Define joint distribution function.
9. Write down any two properties of joint density function for continuous random variables.
10. Write down the relationship between independence and conditional probability.

(8×1=8 weightage)

Part B (Short Essay/Problems)

Answer any **six** questions.

Weight 2 each.

11. Three people are randomly selected to report for jury duty. The gender of each person is noted by the country clerk. a) What is the probability that only one of the three is a man? b) What is the probability that all three are women?





12. A French restaurant in Riverside, California, offers a special summer menu in which, for a fixed dinner cost, you can choose from one of two salads, one of two entrees, and one of two desserts. How many different dinners are available?
13. Find the probability of drawing a jack 3 times in succession from a pack of 52 playing cards a) If the cards are not replaced, b) If the cards are replaced.
14. A worker-operated machine produces a defective item with probability 0.01 if the worker follows the machine's operating instructions exactly, and with probability 0.3 if he does not. If the worker follows the instructions 90% of the time, what proportion of all items produced by the machine will be defective?
15. Suppose that the random variable X takes on three values -1, 0 and 1 with probabilities $11/32$, $16/32$ and $5/32$ respectively. Then find the probability distribution of $Y=2X+1$
16. Given the pdf of a random variable X as $f(x) = \begin{cases} 5e^{-5x} & 0 < x < \infty \\ 0 & \text{elsewhere} \end{cases}$. Show that $P(X \geq 7|X \geq 5) = P(X \geq 2)$.
17. Define joint probability mass function with properties.
18. A two dimensional random variable (x,y) have a bivariate distribution given by $P(X=x,Y=y) = \frac{x^2+y}{32}$, for $x= 0,1,2,3$ and $y=0,1$
Find the marginal distributions of X and Y .

(6×2=12 weightage)

Part C (Essay Type Questions)

Answer any **two** questions.

Weight **5** each.

19. a) If $B \subset A$ then i) $P(A \cap B^c) = P(A) - P(B)$ ii) $P(B) \leq P(A)$. b) State and prove Boole's inequality.
20. During the inaugural season of Major League Soccer in the United States, the medical teams documented 256 injuries that caused a loss of participation time to the player. The result of this investigation, reported in The American Journal of Sports Medicine, are shown in the table.

Severity	Practice (P)	Game (G)	Total
Minor (A)	66	88	154
Moderate (B)	23	44	67
Major (C)	12	23	35
Total	101	155	256

If one individual is drawn at random from this group of 256 soccer players, find the following probabilities: a) $P(A)$ b) $P(G)$ c) $P(A \cap G)$ d) $P(G|A)$ e) $P(G|B)$ f) $P(G|C)$ g) $P(C|P)$ h) $P(B^c)$





21. a) Explain the methods of obtaining the pdf of the function of a continuous random variable. b)

X has the pdf $f(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}}$, $-\infty < x < \infty$. Find the density function of $Y = X^2$

22. Let X and Y be a pair of discrete random variable with joint probability distribution as follows-

$Y \setminus X$	0	1	2
0	1/24	2/24	4/24
1	4/24	1/24	4/24
2	3/24	3/24	2/24

- i) Find the Conditional distribution of $(Y|X=2)$
ii) Find the conditional distribution of $(X/Y=1)$

(2×5=10 weightage)

