

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: IMSc
BRANCH: QEDS

SEMESTER : III
SESSION : MO/2025

SUBJECT: ED24207 PROBABILITY II

TIME: 02 Hours

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
-

- Q.1 Find the pdf of sum of 2 independent random variable using moment generating function method each of which is Gamma with parameters α and β ? [5] CO C01 BL II
- Q.2 The joint distribution of X and Y is given by, [5] C01 IV
$$f(x, y) = 4xye^{-(x^2+y^2)} ; x \geq 0, y \geq 0$$

Test whether X and Y are independent.
For the above joint distribution, find the conditional density of X given Y=y.
- Q.3 Let (X,Y) be a 2-dimensional non-negative continuous random variable having the joint density: [5] C01 III
$$f(x, y) = 4xye^{-(x^2+y^2)} ; x \geq 0, y \geq 0 .$$

Find the density function of $U = \sqrt{X^2 + Y^2}$.
- Q.4(a) Find k so that $f(x,y) = kxy$, $1 \leq x \leq y \leq 2$ will be a pdf. [2] C02 III
- Q.4(b) If $f(x, y) = \begin{cases} e^{-(x+y)} & ; x \geq 0, y \geq 0 \\ 0 & \text{otherwise} \end{cases}$ is the joint pdf of random variable X and Y, [3] C02 III
find i) $P(X < 1)$ ii) $P(X > Y)$ iii) $P(X+Y < 1)$
- Q.5(a) Obtain the moment generating function of Chi-square(χ^2) distribution. [2] C02 I
- Q.5(b) Show that if $X \sim \chi^2_{(n)}$, then $\frac{X}{2} \sim \text{Gamma}(1, \frac{n}{2})$ [3] C02 III

:::22/09/2025 :::E