4/16

0905E548

Candidate's Seat No:____

B.Sc. NEP) Sem.2 Examination

DSC-C-121

Statistics

May-2025

Time : 2-00 Hours]

Instructions **[Max. Marks : 50**

1. *Figures to the right indicate full marks of the question/sub-question.*
2. *Notations used in this question paper carry their usual meaning.*
3. *Use of scientific calculator is allowed.*
4. *Statistical & logarithmic tables and graph papers will be provided on request.*

Q-1 *a) (1)* Define terms: *sample space, Events, certain event, difference events, mutually exclusive event.* **(05)**

(2) In usual notations, state *addition rule* of *probability for two and three events.* With reference to this, answer the following: **(05)**
If a student passes an exam of Statistics subject is 4/7, probability that he passes mathematics exam is 3/5 and if passes the exam of either Statistics subject of Mathematics subject is 3/5. Find the probability he passes exams of both Statistics and Mathematics subjects.

OR

a) (1) Define independence of events.
In usual notations, if A and B are independent events, then prove that events $\bar{A}$ and $\bar{B}$ are independent. **(05)**

(2) State and prove *Bayes' Rule of probability.* **(05)**

b) **Answer following (Any Three)** **(03)**

(1) Define impossible event and equi probable event.

(2) State multiplicative rule of probability, independence of events.

(3) If A and B are independent events, and if $P(A) = 0.55$ and $P(B)=0.35$, find P(A|B).

(4) If two events A and B are independent events, is it true that $P(\bar{A}|B) = P(\bar{A})$?

(5) For two events A and B, P(A) =0.30, P(B)=0.40, and if A and B are mutually exclusive events, find the value of $P(A|\bar{B})$.

(P.T.O)

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Q-2 *a) (1)* Define following terms: **(05)**

(i) Random variable, (ii) probability density function.

For a random variable *X*, p.d.f is given as under:

$$p(x) = \begin{cases} c(x^2+1), 0 < x < 1 \\ 0 \quad , otherwise \end{cases}$$

Determine (i) constant c, (ii) *P(X>1/2), (iii) P(1/3<X<1/2)*

(2) A balanced coin tossed 4 times. The probability mass function of number of heads obtained is as under: **(05)**

$$p(x) = \begin{cases} k\binom{4}{x}, x = 0,1,2,3,4 \\ 0 \quad , otherwise \end{cases},$$

Then, *(i) Show that k = 1 / 16, (ii) Find Mean, variance, E (2X+3)*

OR

a) (1) In case of *bivariate distribution function*, define *marginal distribution* and *conditional distribution.* **(05)**

The *joint probability distribution of* random variables *(X, Y) is*

Y	*X*	
	1	*2*
0	*1/5*	*2/5*
1	*1/5*	*1/5*

Find marginal distribution of *X* and conditional distribution of *Y* given *X*.

(2) The following is a probability mass function of a random variable X, **(05)**

$$p(x) = \begin{cases} ax^2, x = 0,1,2 \\ 0, \ otherwise \end{cases}$$

Find (i) constant a, (ii) distribution function F9x), (iii) P(X>0), P(X.2)

b) **Answer following (Any Three)** **(03)**

(1) Define probability density function. State the relation between probability density function and probability distribution function.

(2) Define cumulative Distribution function.

(3) For a discrete probability function, the shape of a cumulative Distribution Function of a is stair case type. Do you agree?

(4) State the conditions for a probability function to be probability mass function.

(5) State the importance of bivariate distribution.

Q-3 *a) (1)* Define terms: raw moments, cumulant generating function, skewness and kurtosis. **(05)**
If X follows a probability density function

$$f(x) = \begin{cases} \frac{1}{3}, 1 < X < 4 \\ 0 \text{ otherwise} \end{cases},$$

Find the value of measure of β_1.

(2) Define terms: moment generating function, cumulant generating function **(05)**
State and prove properties of moment generating function.

OR

a) (1) The probability density function of a random variable X is $f(x) = e^{-x}, x > 0$, obtain moment generating function. Also, derive first two raw moments using moment generating function. **(05)**

(2) State the importance of cumulant generating function in context of Probability distribution. **(05)**

b) Attempt any ***TWO***. **(02)**

(1) Define central moments.

(2) State one use of factorial moment generating function.

(3) If the moment generating function is $M_x(t) = e^{-m+me^m}$, then write the value of cumulant generating function.

(4) What are different measures of locations?

Q-4 *a) (1)* State the purpose of transformation of random variable. **(05)**
In usual notations, show that $g(y) = f(x)\left|\frac{dx}{dy}\right|$, Where Y=g(x) is a strictly monotonically increasing function of X.

(2) Using Jacobian of transformation, obtain probability density function of $Y = X^2$. **(05)**

OR

a) (1) Using Jacobian of transformation, obtain probability distribution of $X - Y$, stating necessary condition. **(05)**

(2) Using Jacobian of transformation, obtain probability distribution of XY, stating necessary condition. **(05)**

b) Attempt any ***TWO***: **(02)**

(1) Define Jacobian of transformation.

(2) Considering polar coordinates, if $x = r\cos\theta$ and $y = r\sin\theta$, then state the value of jacobian of polar transformation.

(P.T.O)

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(3) The Jacobian of the transformation for x = v/u, and y = v is $-\frac{v}{u^2}$. Do you agree?

(4) A jacobian is a determinant of a matrix of partial derivatives of function of new variables. Comment on this statement.

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