## MALLA REDDY COLLEGE OF EIGINEERIIG \& TECHNOLOGY

# B.Tech 

Aeronautical Engineering

# Department of AERONAUTICAL ENGINEERING 

## PROBABILITY \& STATISTICS

## QUESTION BANK

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II B.Tech II Semester Supplementary Examinations, January 2024 Probability and Statistics


Time: 3 hours
Max. Marks: 70
Note: This question paper Consists of 5 Sections. Answer FIVE Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.
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## SECTION-I

$1 \quad \boldsymbol{A}$ Define Continuous Random Variable with example.
$\boldsymbol{B} \quad$ A Random variable X has the following probability distribution

| X | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathrm{P}(\mathrm{X})$ | K | 2 K | 3 K | 4 K | 5 K | 6 K | 7 K | 8 K |

Find the value of (i). $\mathrm{K} \quad$ (ii). $\mathrm{P}(\mathrm{X} \leq 2)$ (iii). $\mathrm{P}(2 \leq \mathrm{X} \leq 5)$
OR
$2 \boldsymbol{A}$ Suppose that the error in the reaction temperature in $0^{\circ} \mathrm{C}$ for a
[4M]
controlled laboratory experiment is a continuous variable X having probability density function
$f(x)=\left\{\begin{array}{l}\frac{x^{2}}{2},-1<x<2 \\ 0, \text { else where }\end{array}\right.$
Verify that $f(x)$ is a density function.
$\boldsymbol{B} \quad$ The joint probability density function is given by
$f(x, y)=\left\{\begin{array}{cc}10 x y^{2}, & 0<x<y<1 \\ & 0, \quad \text { elsewhere }\end{array}\right.$
a) Marginal probability density function of $X$
b) Marginal probability density function of Y
c) Conditional probability density function of X given Y
d) Conditional probability density function of $Y$ given $X$

## SECTION-II

$3 \quad \boldsymbol{A}$ Prove that mean and variance of a poisson distribution are same
$\boldsymbol{B} \quad$ If ' X ' is a normal variate with mean 30 and standard deviation 5. Find the probabilities that
(i). $26 \leq X \leq 40$
(ii). $X \geq 45$

OR
$4 \boldsymbol{A} \quad$ Write the chief characteristics of Normal Distribution.
B In a normal distribution, $8 \%$ of the items are under 35 and $90 \%$ of the
[4M]
[10M] items are under 63. Determine the mean and variance of the distribution.

## SECTION-III

$5 \quad \boldsymbol{A}$ If $\sigma_{x}=\sigma_{y}=\sigma$ and the angle between two regression lines is $\operatorname{Tan}^{-1}\left(\frac{4}{3}\right)$. Find ' $r$ '
$\boldsymbol{B}$ Find the mean values of the variables ' X ' and ' Y ' and correlation coefficient from the following regression equations.
$2 \mathrm{Y}-\mathrm{X}=50$ and $3 \mathrm{Y}-2 \mathrm{X}=10$

OR
$6 \quad \boldsymbol{A} \quad$ Write the properties of correlation coefficient.
B A random of 5 college students is selected and their marks in mathematics and Statistics are found to be

| Mathemat <br> ics | 85 | 60 | 73 | 40 | 90 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Statistics | 93 | 75 | 65 | 50 | 80 |

Calculate rank correlation coefficient.

## SECTION-IV

$7 \quad \boldsymbol{A} \quad$ Define Type-I and Type-II errors.
$\boldsymbol{B} \quad$ A sample of 400 items is taken from a population whose standard
[2M] deviation is 10 .The mean of the sample is 40. Test whether the sample has come from a population with mean 38 .Also calculate $90 \%$ confidence interval for the population.

## OR

$8 \quad \boldsymbol{A} \quad$ Explain the procedure for testing of Hypothesis.
$\boldsymbol{B}$ The means of two large samples of sizes 1000 and 2000 members are 67.5 inches and 68 inches respectively. Can the samples be regarded as drawn from the same population of S.D 2.5 inches.

## SECTION-V

$9 \quad \boldsymbol{A} \quad$ Write the applications of t -distribution.
B In a sample 500, form a village in Telanagana 280 is found to be rice eaters and rest of them wheat eaters. Can we assume that both articles are equally popular?

## OR

$\mathbf{1 0} \quad \boldsymbol{A} \quad$ Write the properties of Chi-Square ?
$\boldsymbol{B}$ The measurements of the output of two units have the following results. Assuming that both samples have been obtained from the normal populations at $10 \%$ significant level, test whether the two populations have the same variance.

| Unit-A | 14.1 | 10.1 | 14.7 | 13.7 | 14.0 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Unit-B | 14.0 | 14.5 | 13.7 | 12.7 | 14.1 |

(EEE, ME \& AE)


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SECTION-I
Marks
A Define Discrete Random Variable and Continuous Random Variable.
B A random variable X has the following distribution

| $\mathrm{X}:$ | 1 | 2 | 3 | 4 | 8 | 9 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{P}(\mathrm{x}):$ | K | 3 K | 5 K | 7 K | 9 K | 11 K |

Determine i. K ii. Mean iii. $\mathrm{P}(\mathrm{x}>3)$
OR
$2 \boldsymbol{A} \quad$ The joint probability density function is given by
$f(x, y)=\left\{\begin{array}{cc}10 x y^{2}, & 0<x<y<1 \\ & 0, \quad \text { elsewhere }\end{array}\right.$
a) Marginal probability density function of $X$
b) Marginal probability density function of $Y$
c) Conditional probability density function of X given Y
d) Conditional probability density function of $Y$ given $X$

B Given that $f(x)=\frac{k x}{2}$, if $\mathrm{x}=1,2,3,4$ is a probability distribution of a random variable X Find K.

## SECTION-II

$\boldsymbol{A}$ Derive the mean of a Poisson Distribution.
$\boldsymbol{B} \quad$ Ten coins are thrown simultaneously. Find the probability of getting :
i) At least one head
ii) At most seven heads

OR
$4 \quad \boldsymbol{A} \quad$ Write the properties of Normal Distribution
B In a normal distribution, $7 \%$ of the items are under 35 and $89 \%$ of the items are under 63. Determine the mean and variance of the distribution.

## SECTION-III

$5 \quad \boldsymbol{A} \quad$ Write the properties of correlation coefficient.

B Calculate the coefficient of correlation from the following data

| X | 12 | 9 | 8 | 10 | 11 | 13 | 7 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Y | 14 | 8 | 6 | 9 | 11 | 12 | 3 |
| OR |  |  |  |  |  |  |  |

[10M]
[14M]

| $\mathrm{X}:$ | 50 | 50 | 55 | 60 | 65 | 65 | 65 | 60 | 60 | 60 |
| :---: | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathrm{Y}:$ | 11 | 13 | 14 | 16 | 16 | 15 | 15 | 14 | 13 | 13 |

## SECTION-IV

$\boldsymbol{A} \quad$ Define (i) Null Hypothesis (ii) Alternative Hypothesis.
$\boldsymbol{B} \quad$ A population consists of five numbers 2,3,6,8, and 11 . Consider all possible samples of size two which can be drawn with replacement from this population ,Find
i)The mean of the population
ii) The standard deviation of the population
iii) The mean of the sampling distribution of means
iv) Standard deviation of the sampling distribution of means.

## OR

Find the two lines of regression between the two variables
$\boldsymbol{A} \quad$ Define Sample and population.
B Sample of 400 men and 600 women were asked whether they would like to have a
flyover near their residence. 200 men and 325 women were in favour of the proposal. Test the hypothesis that proportions of men and women in favour of the proposal are same, at 5\%level.

## SECTION-V

$\boldsymbol{A} \quad$ Write the properties of t -distribution.
$\boldsymbol{B} \quad$ A random sample of 10 boys had the following I.Q's: 70, 120, 110, 101, 85, 83, 95, 100 ?

## OR

$\boldsymbol{A} \quad$ Write the applications of chi-square distribution.
$\boldsymbol{B}$ Two horses ' A ' and ' B ' were tested according to the time( in seconds) to run a particular track with the following results:

| Horse 'A' | 28 | 30 | 32 | 33 | 33 | 29 | 34 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Horse 'B' | 29 | 30 | 30 | 24 | 27 | 29 |  |

Test whether the two horses have the same running capacity.
(ME\& AE)

| Roll No |  |  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

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## SECTION-I

1a. Given that $p(x)=\frac{k x}{2}$, if $\mathrm{x}=1,2,3,4$ is a probability distribution of a random variable ' X ' then find the value of ' K '
b A random variable ' X ' has the following distribution

| $\mathrm{X}:$ | 1 | 2 | 3 | 4 | 8 | 9 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{P}(\mathrm{x}):$ | K | 3 K | 5 K | 7 K | 9 K | 11 K |

Determine
i). K
ii). Mean

2 Is $f(x)=x^{2} e^{-x}$ when $x \geq 0$ can be regarded as a probability function for a continuous random variable? If so find Mean and Variance of the random variable.

## SECTION-II

3a If a random variable has a Poisson distribution such that $\mathrm{P}(1)=\mathrm{P}(2)$,
find (i). Mean of the distribution (ii). P (4)
b Define Poisson Distribution and derive the mean of a Poisson Distribution.
4 In a Normal Distribution $31 \%$ of the items are under 45 and $8 \%$ of the items are over 64. Find the mean and variance of the distribution.

## SECTION-III

5 Heights of fathers and Sons (in inches ) are given in the following table

| Heights of father | 65 | 66 | 67 | 67 | 68 | 69 | 71 | 73 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Heights of Son | 67 | 68 | 64 | 68 | 72 | 70 | 69 | 70 |

Form the two lines of regression and calculate the expected average heights of the Son when the height of the father is 67.5

OR
6 Find the rank correlation coefficient for the following data.

| X | 50 | 60 | 65 | 54 | 69 | 65 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Y | 68 | 49 | 62 | 61 | 58 | 61 |

## SECTION-IV

7a A random population has a mean of 0.1 and standard deviation of 2.1 find the
probability that mean of a sample of size 900 will be negative.
b A random sample of size 64 is taken from an infinite population having the mean 45 and standard deviation 8 . What is the probability that ' $x$ ' will be between 46 and 47.5

OR
8 A population consists of five numbers $2,3,6,8$ and 11. Consider all possible samples of size two which can be drawn with replacement from the population. Find
(i). The mean of the population.
(ii). The Standard Deviation of the population.
(iii). The mean of the sampling distribution of means and
(iv). The Standard Deviation of the sampling distribution of means.

## SECTION-V

9 Random samples of 400 men and 200 women in a locality were asked whether they would like to have a bus stop to their residence. 200 men and 40 women were in favour of the proposal. Test the significance between the difference of two proportions at $5 \%$ level.

OR
10 A random sample of 10 bags of pesticides is taken whose weights are 50, 49, 52, $44,45,48,46,45,49,45$ (in kgs) Test whether the average packing can be taken to be 50 kgs .
[7M]
[7M]
[14M]

MALLA REDDY COLLEGE OF ENGINEERING \& TECHNOLOGY (Autonomous Institution - UGC, Govt. of India)
II B.Tech II Semester Supplementary Examinations, April 2023 Probability \& Statistics
(ME\& AE)

| Roll No |  |  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

## Time: 3 hours

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## SECTION-I

1 A random variable X has the following distribution

| $\mathrm{X}:$ | 1 | 2 | 3 | 4 | 8 | 9 |
| :--- | :--- | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{P}(\mathrm{x}):$ | K | 3 K | 5 K | 7 K | 9 K | 11 K |

OR
2 Is $f(x)=x^{2} e^{-x}$ when $x \geq 0$ can be regarded as a probability function for a continuous random variable? If, so find Mean and Variance of the random variable

## SECTION-II

3a Ten coins are thrown simultaneously. Find the probability of getting :
i) At least one head ii) At least four heads
b Define Binomial Distribution and derive the mean of Binomial Distribution.

4 In a normal distribution, $7 \%$ of the items are under 35 and $89 \%$ of the items are under 63. Determine the mean and variance of the distribution.

## SECTION-III

5 Calculate the coefficient of correlation between the two variables ' $x$ ' and ' $y$ '

| X | 2 | 3 | 8 | 11 | 4 | 5 | 9 | 7 | 5 | 7 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Y | 21 | 42 | 102 | 130 | 52 | 57 | 105 | 85 | 62 | 90 |

OR
6 For the following data,
find the equations of two regression lines.

| X | 1 | 2 | 3 | 4 | 5 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Y | 15 | 25 | 35 | 45 | 55 |

## SECTION-IV

7a Define (i). Population (ii). Sample (iii).Parameter (iv).Statistic
b When a sample is taken from an infinite population, what happen to the standard error of the mean if the sample size is decreased from 800 to 200.

## OR

8 A population consists of five numbers $2,3,6,8$ and 11. Consider all possible samples of size two which can be drawn with replacement from the population. Find
(i). The mean of the population.
(ii). The Standard Deviation of the population.
(iii). The mean of the sampling distribution of means and
(iv). The Standard Deviation of the sampling distribution of means.

SECTION-V
9 A sample of 400 items is taken from a population whose standard deviation is 10.The mean of the sample is 40 .Test whether the sample has come from a population with mean 38. Also calculate $95 \%$ confidence interval for the population.

OR

10 Two samples are drawn from two normal population's .Test whether the two samples have the same variance at $5 \%$ level.

| Sample-I | 60 | 65 | 71 | 74 | 76 | 82 | 85 | 87 | - | - |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Sample-II | 61 | 66 | 67 | 85 | 78 | 63 | 85 | 86 | 88 | 91 |

