उत्तर प्रदेश राजर्षि टण्डन मुक्त विश्वविद्यालय, प्रयागराज

सांख्यिकी (स्नातक) कार्यक्रम अधिन्यास 2021–22

कोर्स कोड : Course Code: CSSSTAT-01	कोर्स शीर्षकः– (Course Title) Statistical Method	अधिकतम अंक : 30 Maximum Marks : 30

खण्ड – 'अ'
Section 'A'
दीर्घ उत्तरीय प्रश्न
Long Answer Questions.

नोट : किन्हीं तीन प्रश्नों के उत्तर 800 से 1000 शब्दों में लिखें।
Note: All questions are compulsory. Each question should be answered in 800 to 1000 Words.

अधिकतम अंकः 18
Maximum Marks: 18

1. With the help of an example describe the method of constructing pie chart.

2. Define Arithmetic mean and show that it is dependent of change of origin as well as change of scale.

3. Define Mean Deviation. Show that mean Deviation is minimum when measured about median of the frequency distribution.

4. Define Geometric mean . Also Define the additive property of Geometric mean .

5. Define Standard Deviation . Also Discuss the effect of Change of origin and scale on it.

6. Discuss Various methods of measurements of data.

7. Discuss about the Arithmetic mean with its application and merits and demerits. Also prove that the A.M. is not independent of change of origin and scale.

8. Discuss about the Disperson. Also Define its all measures of Dispersion in detail.

9. Discuss about the co-efficient of variation in the following data find which series has less C.V.

Series A	5	9	12	8
Series B	7	12	19	10
C.I	10-20	20-30	30-40	40-50

Section - B
लघु उत्तरीय प्रश्न
Short Answer Questions.

अधिकतम अंकः 12
Maximum Marks: 12

नोट : किन्हीं चार प्रश्नों के उत्तर 200 से 300 शब्दों में लिखें।
 Note: Write any four questions. Answer should be given in 200 to 300 Words.

1. Define Harmonic Mean and give its one application.

2. What is the difference between multiple bar diagram and Divided bar diagram.

3. Define coefficient of variation. For what purpose is it used.
4. Discuss about Pie chart and Pictograph
5. Give short notes on Geograph mean with its merits & Demonts.
6. Discuss about the Histogram and Ogive.
7. State and Prove combined property of the variance
8. State and prove first property of the mean

उत्तर प्रदेश राजर्षि टण्डन मुक्त विश्वविद्यालय, प्रयागराज

सांख्यिकी (स्नातक) कार्यक्रम अधिन्यास 2021—22

कोर्स कोड : Course Code: CSSSTAT-02	कोर्स शीर्षकः— (Course Title) Probability & Distribution	अधिकतम अंक : 30 Maximum Marks : 30

खण्ड — 'अ'

Section 'A'

दीर्घ उत्तरीय प्रश्न

Long Answer Questions.

नोट : किन्हीं तीन प्रश्नों के उत्तर 800 से 1000 शब्दों में लिखें।

Note: All questions are compulsory. Each question should be answered in 800 to 1000 Words.

अधिकतम अंक: 18

Maximum Marks: 18

1. Define Binomial Distribution. Also Calculate its moment generation function.
2. Define Normal Distribution. Also Discuss about the area property and characteristic function of normal distribution.
3. What is random variable. Differentiate the probability mass function (p.m.f.) and probability density function (p.d.f.).
4. Each of n urns contains four white and six black balls, while another urn contains five white and five black balls. An urn is chosen at random from these intel urns and two balls are drawn from it both being black. The probability that five white and three black balls remain in the chosen urn is 1/7. Find the value of n.
5. The probability mas functions of a random variable X is given by

$$b(x) = P(x = x) \begin{cases} \binom{x+4}{x}\left(\frac{1}{3}\right)^5 \left(\frac{2}{3}\right)^x & if \ x = 0,1,2....... \\ O, otherwise \end{cases}$$

   Obtain (i) E (x) (ii) Moment generating function of X.

6. The probability density function of a random variable X I given by

$$f(x) = \frac{1}{4\sqrt{\pi}} e \frac{-(x-10)^2}{32}, \ -\infty < x < \infty$$

   Obtain (i) E(x) (ii) E (x^2) and E (x^4)

7. For three mutually independent events A, B and C, verify if A^c, B^c, C^c are also mutually independent or not?

8. Let one out of 1000 person in a population suffer from a particular disease. Assume that a test wrongly detects the person suffering from disease is 5% and test correctly detects the person suffering from disease is 99%. What is the probability that a randomly selected person tested to have disease actually has the disease?

9. A fair dice is thrown two times. Let X be the number obtained in the first throw and Y be the minimum of two numbers obtained. Obtain joint pmf of (X, Y). Also obtain (i) conditional distribution of Y given X = 4, (ii) E(XY =4)

खण्ड – ब
Section - B
लघु उत्तरीय प्रश्न
Short Answer Questions.

अधिकतम अंक: 12
Maximum Marks: 12

नोट : किन्हीं चार प्रश्नों के उत्तर 200 से 300 शब्दों में लिखें।
Note: Write any four questions. Answer should be given in 200 to 300 Words.

1. If X ~ B (10, ¼). Then calculate the mean and variance of the distribution.
2. If $X_1 \sim N (\mu, \sigma_1^2)$ and $X_2 \sim N (\mu_2, \sigma_1^2)$ then $X_1 + X_2$ follows which distribution. Prove it.
3. What is mathematical expectation. Also calculate the values of E $(ax_1 + bx_2)$. and V $(ax_1 + bx_2)$ where X_1 and X_2 be the iid random variables
4. State and Prove Baye's theory.

5. For two events A and B, show that ,
   $P(A \cup B) = P (A) + P(B) - P(A \cap B)$

6. Define conditional robability and give an example.

7. The probability mass function of a random variable X is given by

   $$b(x) = P(x = x1 = \begin{cases} \dfrac{1}{5} (\dfrac{4}{5})^x & if \ x=0,1,2,...... \\ 0, other \ wise \end{cases}$$

   Show that P (x > 10 / x > 3) = P (x >, 7)

8. The p.d.f. of a random variable X is given by

$$\begin{cases} \dfrac{1}{\beta} e^{-x/\beta} & \text{if } x > 0, \beta > 0 \\ 0, & \text{otherwise} \end{cases}$$

Obtain the moment generating function of X.

9. If $A \cap B \cap C = \Phi$, $A \Rightarrow B$, then find $(P(A \cap C)$.

10. The pmf of a random variable X is binomial with parameters (n, p). If E[X]=10, E(X(X-1)]=95, then obtain n and p.

11. A fair dice is thrown unless one obtains either 1 or 6. Let X be the number of throws then obtain E(X).

12. The pdf of a random variable is given by

$$f(x) = kx(1-x); 0 < x < 1$$

Find the constant k. Also obtain E(X) and P(X>1/2 | X<1/5).

उत्तर प्रदेश राजर्षि टण्डन मुक्त विश्वविद्यालय, प्रयागराज

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कोर्स कोड : Course Code: CSSSTAT-03	कोर्स शीर्षकः– (Course Title) Correlation, Regression & Statistical Inference	अधिकतम अंक : 30 Maximum Marks : 30

खण्ड – 'अ'
Section 'A'
दीर्घ उत्तरीय प्रश्न
Long Answer Questions.

नोट : किन्हीं तीन प्रश्नों के उत्तर 800 से 1000 शब्दों में लिखें।
Note: All questions are compulsory. Each question should be answered in 800 to 1000 Words.

अधिकतम अंकः 18
Maximum Marks: 18

1. Discuss about the Regression. Find out the angle between two regression lines.

2. Define the Spearman Correlation Coefficient also calculate from the following data.

X	17	23	29	13	09	23
Y	14	22	22	19	14	08

3. State and Prove Rao Blackwell theorem.

4. Discuss about the effect of change of origin and scale on correlation coefficient.

5. Define non arametic tests. Also discuss about the Mann – whitney U-test.

6. Discuss about the all properties of a good estimator.

7. Prove that: with n number of attributes defined over a group of individuals or units, there are 3^n total numbers of classes or class frequencies.

8. Prove that: If a sufficient estimator exists, then maximum likelihood estimator is a function of the sufficient estimator.

9. (a) Discuss about the Mann-whitney U-test.

   (b) Write in short about the wilcoxon signed Rank Test.

अधिकतम अंक: 12
Maximum Marks: 12

नोट : किन्हीं चार प्रश्नों के उत्तर 200 से 300 शब्दों में लिखें।
Note: Write any four questions. Answer should be given in 200 to 300 Words.

1. Write short notes on efficiency and sufficiency.
2. Discuss about Unbiased ners and Consistency
3. Discuss about the effect of change of origin and scale on correlation coefficient.
4. Write down the all properties of regression coefficient.
5. Write notes on

a) Goodness of fit .

b) Sign test and Run test.

6. Writes short notes on

a) contingency table

b) Yates correction.

7. Define

a) Critical region and Acceptance region.

b) MP & UMP test.

8. Write short notes on : Goodness of fit.

9. Significance test for "equality of means."

10. Types of error.

11. Properties of good estimator.

12. Effect of change of origin and scale on the correlation coefficient.

13. Spearman Rank correlation coefficient.

उत्तर प्रदेश राजर्षि टण्डन मुक्त विश्वविद्यालय, प्रयागराज

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कोर्स कोड : Course Code: CSSSTAT-04	कोर्स शीर्षकः– (Course Title) Sampling Theory & Design of Experiment.	अधिकतम अंक : 30 Maximum Marks : 30

खण्ड – 'अ'
Section 'A'
दीर्घ उत्तरीय प्रश्न
Long Answer Questions.

नोट : किन्हीं तीन प्रश्नों के उत्तर 800 से 1000 शब्दों में लिखें।
Note: All questions are compulsory. Each question should be answered in 800 to 1000 Words.

अधिकतम अंकः 18
Maximum Marks: 18

1. Calculate the mean and variance of SRSWOR.
2. Give the complete layout and statistical analysis of RBD. Also give its ANOVA table.
3. Discus about the latin square design (LSD) Give its different steps for its statistical analysis, also give its ANOVA table.
4. Discuss about the Non Sampling Errors .
5. Define Linear models. Also give the complete lay out of One way Classified data Also give its ANOVA.
6. Discuss about the
   (a) Efficiency of RBD
   (b) Efficiency of LSD.

7. For SRSWOR, Prove that

   $\bar{y}$ is an unbiased estimates of $\bar{Y}$ and its variance is

   $$V(\bar{y}) = \frac{N-n}{N} \frac{S^2}{n}$$

8. Prove that,

   The first approximation to the variance of the ratio estimator of the population total is given by.

   $$V_1\left(\hat{Y}_R\right) = \left(\frac{N-n}{Nn}\right) N^2 \left(Sy^2 + R^2 Sx^2 - 2\int R\, Sy\, Sx\right)$$

9. Prove that

   $$V(\bar{y}st) \le V\left(\bar{Y}opt\right) \ge V\left(\bar{Y}SRSWOR\right)$$

अधिकतम अंक: 12
Maximum Marks: 12

नोट : किन्हीं चार प्रश्नों के उत्तर 200 से 300 शब्दों में लिखें।
Note: Write any four questions. Answer should be given in 200 to 300 Words.

1. Discuss about the principle of Design of experiment.
2. Discuss about the Systematic Sampling also find its mean and variance.
3. Discuss about the different methods for collecting the sample under simple random sampling. (SRS)
4. Write short note on   (a) Precision   (b) Efficiency of Design
5. Define Basic Principle of Resign of Experiments.
6. Distinguish the Difference Between multistage Sampling and Two phase Sampling.
7. Discuss about the Measures of Sampling Errors.

8. Precision and Efficiency of a design.

9. Systematic Sampling.

10. Sampling and non sampling errors.

11. Sources of non responce errors.

12. Linear models.

13. Basic Principles of Design of experiment.

उत्तर प्रदेश राजर्षि टण्डन मुक्त विश्वविद्यालय, प्रयागराज

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कोर्स कोड : Course Code: CSSSTAT-05	कोर्स शीर्षकः— (Course Title) Numerical Methods & Basic Computers Knowledge	अधिकतम अंक : 30 Maximum Marks : 30

खण्ड – 'अ'
Section 'A'
दीर्घ उत्तरीय प्रश्न
Long Answer Questions.

नोट : किन्हीं तीन प्रश्नों के उत्तर 800 से 1000 शब्दों में लिखें।
Note: All questions are compulsory. Each question should be answered in 800 to 1000 Words.

अधिकतम अंकः 18
Maximum Marks: 18

1. Discuss about the different generations of the computers.
2. Describe (a) Trapezoidal rule (b) Eular- Maculerain Formula
3. State and Prove Newton – Gregory Backward Interpolation formula
4. What do you mean by divided differences? State and prove their properties. Also derive their relationship with forward differences.
5. What is numerical differentiation ? Derive the relationship between differential operator (D) and Shift operator (E).
6. Write a defiled Comparative note on various low-level and high-level programmly languages.
7. Differentiate between E and Δ. Also show that

$$\left(\frac{\Delta^2}{E}\right)e^x \cdot \frac{Ee^x}{\Delta^2 e^x} = e^x,$$ the interval of differencing being h.

8. What do you understand by divided difference? Show that they are symmetrical in all the arguments.
9. Derive Bessel's formula in terms of central difference operator (δ) and mean value operator (μ).

लघु उत्तरीय प्रश्न
Short Answer Questions.

नोट : किन्हीं चार प्रश्नों के उत्तर 200 से 300 शब्दों में लिखें।
Note: Write any four questions. Answer should be given in 200 to 300 Words.

1. Write short note as : (a) Simpson's one third rule and (b) Waddle's rule
2. Discuss about the Disk Management Commands.
3. Draw a flow chart to obtain factorial of positive integer n.
4. Discuss about the Stirling's formula and Bessel's formula.
5. Define inverse interpolation with example.
6. Derive Simpson's One- third formula for numerical integration.
7. Differentiate between algorithm and flow-Chart Also, write algorithm and flow –Chart for finding median of green data.
8. Discuss any one method of estimating missing terms with example.

9. Prove that   4

$$y_x = \Sigma_{i=1,2,3...} \frac{(-1)^{i+1}}{ih} (Y_{x+ih} - Y_{x-ih})$$

10. Using Simpson's $\left(\frac{1}{3}\right)^{rd}$ formula prove that   4

$$\int_a^b f(x)dx = \frac{b-a}{6n} \left[f(x_0) + 4f(x_1) + 2f(x_2) + ... + f(x_{2n}) \right]$$

where $x_o = a$ & $x_{2n} = b$

उत्तर प्रदेश राजर्षि टण्डन मुक्त विश्वविद्यालय, प्रयागराज

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कोर्स कोड : Course Code: CSSSTAT-06	कोर्स शीर्षकः– (Course Title) Applied Statistics	अधिकतम अंक : 30 Maximum Marks : 30

खण्ड – 'अ'
Section 'A'
दीर्घ उत्तरीय प्रश्न
Long Answer Questions.

नोट : किन्हीं तीन प्रश्नों के उत्तर 800 से 1000 शब्दों में लिखें।
Note: All questions are compulsory. Each question should be answered in 800 to 1000 Words.

अधिकतम अंकः 18
Maximum Marks: 18

1. Define index number. Also give an idea about the deal Index Number.

2. Discuss about the (a) Factor Reversal Test (b) Time Reversal Test

3. Describe control charts. Also draw the steps control chart of $\bar{x}$ & R.

4. Write down the all criteria of a good index numbers.
5. Discuss about the methods of link relatives.
6. Discuss about the Double Sampling plan.
7. Discuss about the criteria of a Good Index Number.
8. Explain GRR and NRR. Show that NRR ≤ GRR. Why? When GRR will be equal to NRR.
9. Discuss about the component of a time series.

खण्ड – ब
Section - B
लघु उत्तरीय प्रश्न
Short Answer Questions.

अधिकतम अंकः 12
Maximum Marks: 12

नोट : किन्हीं चार प्रश्नों के उत्तर 200 से 300 शब्दों में लिखें।
Note: Write any four questions. Answer should be given in 200 to 300 Words.

1. Write short notes on GRR and NRR.
2. Give the different steps for p-chart and d-chart.

3. Discuss about the time series. Also give its different trends.
4. Discuss about different steps for the method of least square.
5. Deter Ideal Index number. Why it is Ideal.
6. Construct the Control Charts for X and R Charts.
7. 3 - σ Central limits.
8. Control charts for number of defects.
9. Infant mortality rate and maternal mortality rate.
10. Total fertility rate.
11. Fisher's Index number.
12. Fitting of Exponential Trend.

उत्तर प्रदेश राजर्षि टण्डन मुक्त विश्वविद्यालय, प्रयागराज
सांख्यिकी (स्नातक) कार्यक्रम अधिन्यास 2021—22

कोर्स कोड : Course Code: CSSSTAT-07	कोर्स शीर्षकः— (Course Title) Operation Research	अधिकतम अंक : 30 Maximum Marks : 30

खण्ड — 'अ'
Section 'A'
दीर्घ उत्तरीय प्रश्न
Long Answer Questions.

नोट : किन्हीं तीन प्रश्नों के उत्तर 800 से 1000 शब्दों में लिखें।
Note: All questions are compulsory. Each question should be answered in 800 to 1000 Words.

अधिकतम अंकः 18
Maximum Marks: 18

1. Discuss about the Linear Programming Also Define the different steps for Graphical solution to LPP.

2. Discuss about the principle of simplex method. Also define non basic variable and artificial variables.

3. Discuss about the different methods for the computation of an initial basic feasible solution.

4. Write a detailed not on classification of models used in operations research.

5. What is a game problem? How do we solve there problems using LPP technique ? Give example.

6. What is a transportation problem? How could it be Considered as LPP? Also, show that number of basic variables in a transportation problem of order m x n, are at the most m+ n -1

7. "Ram can buy young hens at Rs. 150 each and old hens at Rs. 120 each. The old hens lay 3 eggs per week and the young ones lay 5 eggs per week, each egg being worth Rs. 4. If any hen costs Rs. 10 per week to feed and Ram has only Rs. 3600 to spend for hens, how many of each kind should Ram buy to give a profit of more than Rs. 70 per week, assuming that Ram cannot house more than 25 hens." Formulate this problem and solve graphically.

8. Solve the following LPP :

$$\text{Max} \quad Z = 5x - 2y + 3z$$
$$\text{subject to} \quad 2x + 2y - z \geq 2$$
$$3x - 4z \leq 3$$
$$y + 3z \leq 3$$
$$\text{and} \quad x, y, z \geq o$$

9. Find the dual of the following primal problem (mention all steps)

Min $Z = x + y + z$

subject to $x - 3y + 4z = 5$

                $x - 2y \leq 3$

                $2y - z \geq 4$

and $x, y, z \geq 0$

खण्ड – ब
Section - B
लघु उत्तरीय प्रश्न
Short Answer Questions.

अधिकतम अंक: 12
Maximum Marks: 12

नोट : किन्हीं चार प्रश्नों के उत्तर 200 से 300 शब्दों में लिखें।

Note: Write any four questions. Answer should be given in 200 to 300 Words

1. Discuss in brief about the Hungarian method.

2. Discuss about the basic assumption of two person sum- zero game.

3. Write a note on pay off matrix.

4. Describe the graphical method for $2 \times n$ or $m \times 2$ games.

5. What is a dual problem? How do we get a dual of given primal ?
6. State and prove reduction theorem for assignment problems.
7. Soles the following LPP graphically (give all steps) .
   a. Max . $Z = 3x + 2y$, subject to x-y $\leq$ 1, x+ y $\geq$ 3 and x , y $\geq$ o .

8. What do you mean by LPP?

9. Write a brief note on phases of OR problem.

10. Discuss geometric properties of LPP.

11. Write a brief note an various types of variables used in LPP.

12. Differentiate clearly between primal and its dual problem (with example).

13. Explain the following terms.

   (i) Feasible solution (FS)

   (ii) Basic solution (BS)

   (iii) Basic feasible solution (BFS).

   (iv) Optimum BFS.

उत्तर प्रदेश राजर्षि टण्डन मुक्त विश्वविद्यालय, प्रयागराज

सांख्यिकी (स्नातक) कार्यक्रम अधिन्यास 2021—22

कोर्स कोड : Course Code: CSSSTAT-08	कोर्स शीर्षकः— (Course Title) Advance Statistical Inference	अधिकतम अंक : 30 Maximum Marks : 30

खण्ड — 'अ'
Section 'A'
दीर्घ उत्तरीय प्रश्न
Long Answer Questions.

नोट : किन्हीं तीन प्रश्नों के उत्तर 800 से 1000 शब्दों में लिखें।
Note: All questions are compulsory. Each question should be answered in 800 to 1000 Words.

अधिकतम अंकः 18
Maximum Marks: 18

1. State and prove Crammer Rao inequality.

2. State and prove Neyman Fisher Factorization theorem.

3. State and prove Lehman- Scheffe theorem.

4. What do you mean by an unbiased estimator? It T is an unbiased estimator of Q, show that $\sqrt{T}$ and T^2 are the biased estimators of $\sqrt{Q}$, and Q^2, respectively.

5. What is sufficiency? Let X_1, X_2 be i,i,d. Poisson (Q) variates. Show that $(X_1 + 3X_2)$ is not sufficient for θ_1 but $(X_1 + X_2)$ is sufficient for θ.

6. Define UMVUE. Also, derive its uniqueness property (i.e. if T_1 and T_2 are two UMVUEs for a parameter θ then $T_1 = T_2$).

7. Let $X \sim P_{N1, N2}$, Where

$$P_{N_1, N_2}(x) = \begin{cases} \dfrac{1}{N_2 - N_1} & X = N1 + 1, N1+2 - N2 \\ O & \text{Otherwise} \end{cases}$$

and $N1, N2$ $(N1 < N2)$ are integers.
Obtain sufficient Statistic when N_1 and N_2 are both unknown.

8. Let $(x_1, x_{2----}x_n)$ be a random Sample of size n from the Poisson Distribution with parameter θ. Obtain an unbiased estimator of e-5 θ.

9. Let $(x_1, x_{2----}x_n)$ be a random Sample of size n

from the Distribution having p.d.t. given by

$$t1x. \theta 1 = \begin{cases} \dfrac{1}{\theta} & e \ x/\theta \ \ x>o, \theta > o \\ O & \text{otherwise} \end{cases}$$

Obtain Uniformly Most Powerful test for testing $H_U : \theta = 1$ against $H_1 : \theta > 1$. Also obtain expression of power function

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खण्ड – ब
Section - B
लघु उत्तरीय प्रश्न
Short Answer Questions.

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अधिकतम अंक: 12
Maximum Marks: 12

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नोट : किन्हीं चार प्रश्नों के उत्तर 200 से 300 शब्दों में लिखें।

Note: Write any four questions. Answer should be given in 200 to 300 Words

1. Write short notes on (a) Power of test (b) Level of Significance

2. MP and UMP test

3. State and prove Neyman- Pearson lemma.

4. Discuss about the confidence interval and confidence coefficient.

5. With the help of on example, show that the maximum like wood estimate is not unique.

6. State Cramer Rao Inequality

7. Define Consistent estimator .

8. Define Most Powerful Test.

9. Write a brief note on sampling distribution.

10. Give an example of unbiased estimator which is not consistent and vice-versa.

11. Let X_1 , X_2 .... , X_n be a random sample of size n from uniform (O, θ). Then obtain sufficient estimator for θ.

12. Clearly differentiate between parameter and statistic.

13. What is C - R inequality? Discuss its importance in brief.

14. Compare parametric tests with non-parameteric tests.