

Topics for First Internal Class Tests-2020-21

TYBSc

Paper	Code	Syllabus
I	RUSSTA501	<p>JOINT MOMENT GENERATING FUNCTION, TRINOMIAL AND MULTINOMIAL DISTRIBUTION:</p> <ul style="list-style-type: none"> • Definition and properties of Moment Generating Function (MGF) of two random variables of discrete and continuous type. Necessary and Sufficient condition for independence of two random variables. <ul style="list-style-type: none"> ➤ Concept and definition of Multivariate MGF. • Trinomial distribution: <ul style="list-style-type: none"> ➤ Definition of joint probability distribution of (X, Y). Joint moment generating function, moments μ_{rs} where $r=0, 1, 2$ and $s=0, 1, 2$. ➤ Marginal & Conditional distributions. Their Means & Variances. ➤ Correlation coefficient between (X, Y). Distribution of the Sum $X+Y$. • Extension to Multinomial distribution with parameters (n, p_1, p_2, \dots, p_{k-1}) where $p_1 + p_2 + \dots + p_{k-1} + p_k = 1$. Expression for joint MGF. Derivation of: joint probability distribution of (X_i, X_j). Conditional probability distribution of X_i given $X_j = x_j$ <p>BIVARIATE NORMAL DISTRIBUTION</p> <ul style="list-style-type: none"> • Definition of joint probability distribution (X, Y). Joint Moment Generating function, moments μ_{rs} where $r=0, 1, 2$ and $s=0, 1, 2$. Marginal & Conditional distributions. Their Means & Variances. • Correlation coefficient between the random variables. Necessary and sufficient condition for the independence of X and Y. Distribution of $aX + bY$, where 'a' and 'b' are constants. • Distribution of sample correlation coefficient when $\rho = 0$. Testing the significance of a correlation coefficient. Fisher's z – transformation. Tests for i) $H_0: \rho = \rho_0$ ii) $H_0: \rho_1 = \rho_2$ • Confidence interval for ρ.

II	RUSSTA502	<p>POINT ESTIMATION AND PROPERTIES OF ESTIMATOR-I:</p> <ul style="list-style-type: none"> • Notion of a parameter and parameter space. Problem of Estimation, • Definitions of Statistic, Estimator and Estimate. • Properties of a good estimator: • Unbiasedness: Definition of an unbiased estimator, biased estimator, positive and negative bias, illustrations and examples (these should include unbiased and biased estimators for the same parameters). Proofs of the following results regarding unbiased estimators. <ul style="list-style-type: none"> (i) Two distinct unbiased estimators of $\phi(\theta)$ give rise to infinitely many unbiased estimators. (ii) If T is an unbiased estimator of θ, then $\phi(T)$ is unbiased estimator of $\phi(\theta)$ provided $\phi(\cdot)$ is a linear function. • Consistency: Consistency: Definition, Proof of the following theorem: An estimator is consistent if its bias and variance both tend to zero as the sample size tends to infinity. • Sufficiency: Concept and definition of Sufficiency, Neymann Factorization Theorem (without proof). Exponential family of probability distributions and Sufficient statistic. • Relative efficiency of an estimator. Illustrative examples. • Minimum variance unbiased estimator (MVUE), Uniqueness property of MVUE. Fisher information function, Statement and proof of Cramer-Rao inequality, Cramer-Rao Lower Bound (CRLB), Definition of Minimum Variance Bound Unbiased Estimator (MVBUE) of $\phi(\theta)$. Definition of Efficient estimator using CRLB. <p>PROPERTIES OF ESTIMATOR- II</p> <ul style="list-style-type: none"> • Minimum variance unbiased estimator (MVUE), Uniqueness property of MVUE. Fisher information function, Statement and proof of Cramer-Rao inequality, Cramer-Rao Lower Bound (CRLB), • Definition of minimum variance bound unbiased estimator (MVBUE) of $\phi(\theta)$. Definition of Efficient estimator using CRLB.
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III	RUSSTA503	<p>EPIDEMIC MODELS</p> <ul style="list-style-type: none"> • The features of Epidemic spread. Definitions of various terms involved. Simple mathematical models for epidemics: Deterministic model without removals, Carrier model. • Chain binomial models. Reed - Frost and Greenwood models. Distribution of individual chains and total number of cases. Maximum likelihood estimator of 'p' and its asymptotic variance for households of sizes up to 4. General Epidemics and Host and Vector model
IV	RUSSTA504	<p>COMPOUND INTEREST AND ANNUITIES CERTAIN:</p> <ul style="list-style-type: none"> • Accumulated value and present value, nominal and effective rates of interest. • Varying rates of interest. Equation of value. Equated time of payment. • Present and accumulated values of annuity certain (immediate and due) with and without deferment period. • Present value for perpetuity (immediate and due) with and without deferment Period. • Present and accumulated values of (i) increasing annuity (ii) increasing annuity when successive instalments form (i) arithmetic progression (ii) Geometric progression (iii) annuity with Frequency different from that with which interest is convertible. Redemption of loan.

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ELEMENTS OF OPERATIONS RESEARCH

Syllabus

UNIT I – LINEAR PROGRAMMING PROBLEM (EXCEPT GRAPHICAL SENSITIVITY):

- Introduction, formation of LPP, solution of LPP using
- Graphical method
- Simplex Method (with and without artificial variable)
- Solution of LPP for unrestricted variables

UNIT II – DUALITY:

- Concept of Duality.
- Its use in solving L.P.P. Relationship between optimum solutions to Primal and Dual.
- Dual Simplex Algorithm.

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Topics for First Internal Class Tests-2020-21

TYBA

Paper	Code	Syllabus
I	RUASTA501	<p>Unit I: Univariate Random Variables (Discrete and Continuous):</p> <ul style="list-style-type: none"> • Moment Generating Function, Cumulant generating Function-Their important properties. Relationship between moments and cumulants and their uses. • Characteristic Function- Its properties (without proof). • Transformation of random Variable <p>Unit II: Standard Discrete Probability Distributions:</p> <ul style="list-style-type: none"> • Uniform, Bernoulli, Binomial, & Hypergeometric distributions. • The following aspects of the above distributions (wherever applicable) to be discussed: • Mean, Mode and Standard deviation. Moment Generating Function, Cumulant • Generating Function, Additive property, Recurrence relation for central Moments, Skewness and Kurtosis (without proof), Limiting distribution.
II	RUASTA502	<p>Concepts:</p> <ul style="list-style-type: none"> • Population, Population unit, Sample, Sample unit, Parameter, Statistic, Estimator, Bias, Unbiasedness, Mean square error & Standard error. • Census survey, Sample Survey. Steps in conducting a sample survey. Concepts of Sampling and Non-sampling errors. • Concepts and methods of Probability and Non-Probability sampling. <p>Simple Random Sampling (SRS):</p> <ul style="list-style-type: none"> • Description of Simple Random Sampling with & without replacement. • Lottery method & use of Random numbers to select Simple random sample.

		<ul style="list-style-type: none"> • Estimation of population mean & total. Expectation & Variance of the estimators, Unbiased estimator of variance of these estimators. • Estimation of population proportion. Expectation & Variance of the estimators, • Unbiased estimator of variance of these estimators. <p>Estimation of Sample size based on a desired accuracy in case of SRS for variables & attributes.</p>
III	RUASTA503	<p>COMPOUND INTEREST AND ANNUITIES CERTAIN:</p> <ul style="list-style-type: none"> • Accumulated value and present value, nominal and effective rates of interest. • Varying rates of interest. Equation of value. Equated time of payment. • Present and accumulated values of annuity certain (immediate and due) with and without deferment period. • Present value for perpetuity (immediate and due) with and without deferment Period. • Present and accumulated values of (i) increasing annuity (ii) increasing annuity when successive instalments form (i) arithmetic progression (ii) Geometric progression (iii) annuity with Frequency different from that with which interest is convertible. Redemption of loan.

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Topics for First Internal Class Tests-2020-21

SYBSc

Paper	Code	Syllabus
I	RUSSTA301	<p>Unit I: Univariate Random Variables (Discrete and Continuous):</p> <ul style="list-style-type: none">• Moment Generating Function, Cumulant generating Function-Their important properties. Relationship between moments and cumulants and their uses.• Characteristic Function- Its properties (without proof).• Transformation of random Variable <p>Unit II: Standard Discrete Probability Distributions:</p> <ul style="list-style-type: none">• Uniform, Bernoulli, Binomial, & Hypergeometric distributions.• The following aspects of the above distributions (wherever applicable) to be discussed:• Mean, Mode and Standard deviation. Moment Generating Function, Cumulant• Generating Function, Additive property, Recurrence relation for central• Moments, Skewness and Kurtosis (without proof), Limiting distribution.
II	RUSSTA302	<p>Concepts:</p> <ul style="list-style-type: none">• Population, Population unit, Sample, Sample unit, Parameter, Statistic, Estimator, Bias, Unbiasedness, Mean square error & Standard error.• Census survey, Sample Survey. Steps in conducting a sample survey. Concepts of Sampling and Non-sampling errors.• Concepts and methods of Probability and Non-Probability sampling. <p>Simple Random Sampling (SRS):</p> <ul style="list-style-type: none">• Description of Simple Random Sampling with & without replacement.• Lottery method & use of Random numbers to select Simple random sample.• Estimation of population mean & total. Expectation & Variance of the estimators, Unbiased estimator of variance of these estimators.

		<ul style="list-style-type: none"> • Estimation of population proportion. Expectation & Variance of the estimators, • Unbiased estimator of variance of these estimators. • Estimation of Sample size based on a desired accuracy in case of SRS for variables & attributes.
III	RUSSTA303	<p>Assignment Problem:</p> <ul style="list-style-type: none"> • Concept. Mathematical Formulation • Solution by: Complete Enumeration Method and Hungarian method. • Variants in Assignment Problem: Unbalanced, Maximization type. • Airline Operating Problem • Travelling Salesman Problem <p>Sequencing: Processing n Jobs through 2 and 3 Machines, 2 Jobs through m Machines and n jobs through m machines</p>

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Topics for First Internal Class Tests-2020-21

SYBA

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I	RUASTA301	<u>UNIT I - ELEMENTARY PROBABILITY THEORY:</u> <ul style="list-style-type: none">• Trial, random experiment, sample point and sample space.• Definition of an event, Operation of events, mutually exclusive and exhaustive events.• Classical (Mathematical) and Empirical definitions of Probability and their properties.• Theorems on Addition and Multiplication of probabilities• Independence of events, Pair-wise and Mutual Independence for three events, Conditional probability, Bayes' theorem and its applications
II	RUASTA302	Assignment Problem: <ul style="list-style-type: none">• Concept. Mathematical Formulation• Solution by: Complete Enumeration Method and Hungarian method.• Variants in Assignment Problem: Unbalanced, Maximization type.• Airline Operating Problem• Travelling Salesman Problem Sequencing: Processing n Jobs through 2 and 3 Machines, 2 Jobs through m Machines and n jobs through m machines

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