2. Mathematical Sciences

MDC-1: Foundations of Mathematical Sciences- I

UNIT-I: Numbers, Division algorithm, Divisibility test, Test of prime numbers. Definition of number system (decimal and binary), Conversion from decimal to binary system and vice – versa. Indices, Logarithm and Antilogarithm, Laws and properties of logarithms. **No of contact hours: 10**

UNIT-II: Percentage, Average, Discount, Profit & loss. Problems based on Age, Time, speed & distance, Time & work, clock & calendar, Partnership, Ratio & Proportions, Simple Interest and Compound Interest, Effective rate of interest, Present value, net present value and future value, Annuities, Calculating value of Regular Annuity, Pipes and Cisterns, Mixture and Allegation, Boats and Streams, Races and Games. **No of contact hours: 13**

UNIT-III: Historical development of statistics, statistics in everyday life, statistics through observed data, Scope, limitations, importance, and applications of statistics in other fields, roles of computer in statistics. Statistical data: primary and secondary data and methods of their collection. Time series data, qualitative data and quantitative data. Data Representation: Frequency distribution, Graphical representation of frequency distribution Histogram, Frequency polygon, Frequency curve, Ogive. **No of contact hours: 11**

UNIT-IV: Data Analysis: Arithmetic mean, Geometric mean, Harmonic mean, Median, Mode and their properties. Partition Values: Quartiles, Deciles, Percentiles. Graphical location of Mode, Quartiles, Deciles and Percentiles. **No of contact hours: 11**

Course Learning Out comes: This course will enable the students to:

(i) learn about numbers, conversion of decimal numbers in binary system and binary to decimal system.
(ii) relate indices and logarithm /antilogarithm and learn about properties of logarithms.
(iii) Learn basic mathematical tools to solve real life problems.
(iv) Know application of mathematical tools in decision making problems
(v) acquire the skill of statistical analysis of data from real life situation in a scientific manner.
(vi) acquire knowledge on the basic aspects of statistical reasoning and drawing conclusions

Text Books:

1. Dinesh Khattar, The Pearson Guide to Objective Arithmetic for Competitive Examinations, Pearson 2nd Edition 2008.
2. S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, S. Chand and Sons, 11th Ed 2002.

Reference Books:

1. R.V. Praveen, Quantitate Attitude and Reasoning, 7th Edition, PHI 2013.
2. A.M. Goon, M.K. Gupta and B. Dasgupta, Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata, 2002.
3. Irwin Miller Marylees Miller, John E. Freund's Mathematical Statistics with Applications, 8th Edition, Pearson 2014.

MDC-2: Foundations of Mathematical Sciences – II

UNIT-I: Mathematical reasoning: Meaning of mathematical statements, Negation, Compound statements, Quantifiers, Converse and Contrapositive of the statement, Implications, Validating statements. Sequence and Series (AP, GP), Logical reasoning: Odd man out and series, Blood relations, Coding Decoding, Logical sequence, Logical matching, Logical thinking, missing numbers, Logic puzzles. **No of contact hours: 11**

UNIT-II: Factorial notations, Permutation & Combination (basic definition and everyday problems), Pigeonhole principle, Mathematical Induction, Binomial theorem (for positive index), Principle of Inclusion and Exclusion, Derangements, Inversion formulae, Inequalities, Solution of inequations, Trigonometry, problems based on height and distances. Mensuration, area, volume, surface area and perimeter. **No of contact hours: 12**

UNIT-III: Measures of Dispersion - Range, Inter-quartile Range, Quartile deviation, Mean Deviation, Standard Deviation, Coefficient of variation. Ideal measures of Dispersion. Idea of Skewness and kurtosis (without moments). Idea of Moment and Moment generating function.

No of contact hours: 12

UNIT-IV: Bivariate distribution, Scalier diagram, Correlation and regression, Karl Pearson's Correlation coefficient and its properties. Two regression lines (without derivation), principle of least squares and fitting of polynomials, Relation between correlation coefficient and regression coefficients. **No of contact hours: 10**

Course Learning Out comes: This course will enable the students to:

(i) understand the truth and false of a logical statement and solve logical problems of real-life situation

(ii) learn combinatorial ideas to solve algebraic and real life problems
(iii) learn techniques to solve daily life problems.
(iv) develop aptitude for applications of statistical techniques in Social sciences & Humanities.

Text Books:

1. Seymour Lipschutz, Theory and problems of Set Theory and Related Topics, 2nd Edition, Schaum's Series, McGraw Hill, 1998.
2. Dinesh Khattar, The Pearson Guide to Objective Arithmetic for Competitive Examinations, Pearson 2nd Edition 2008.
3. Richard A. Brualdi, Introductory Combinatorics, 5th Edition Pearson Education Inc., 2009.
4. S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, S. Chand and Sons, 11th Ed 2002.

Reference Books:

1. Ajit Kumar, S. Kumaresan, Bhaba Kumar Sarma, A foundation Course on Mathematics, Alpha Science International Ltd, Oxford, UK. Frist Edition 2018.
2. R.V. Praveen, Quantitate Attitude and Reasoning, 7th Edition, PHI 2013.
3. A.M. Goon, M.K. Gupta and B. Dasgupta, Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata, 2002.
4. Irwin Miller Marylees Miller, John E. Freund's Mathematical Statistics with Applications, 8th Edition, Pearson 2014.

MDC-3: Foundations of Mathematical Sciences – III

UNIT-I: Set theory and its simple applications, Types of sets and their notations, Subsets, Classes of Sets, Power Sets, Venn diagrams, Operations on sets, Ordered pairs, Cartesian product of two sets. Finite sets, Fundamental Principle of Counting, sum rule and product role of counting. Relations & Functions (definitions, examples and solution techniques).

No of contact hours: 10

UNIT-II: Matrices and determinants: Addition, Subtraction and Multiplication of matrices with their properties (only upto third order). Determinants with properties and solution of systems of linear equations with the help of determinant (only upto third order) problems related to economics and business.
No of contact hours: 10

UNIT-III: Differential Calculus: Basic concept of limit and continuity of a function; derivative of a function, Rule of differentiation, Derivative as a Rate of Change, Product Rule, Quotient Rule, Chain Rule, Derivatives of Logarithmic Functions, Exponential Functions, Elasticity of Demand and supply. Second Order Derivatives, Maxima and Minima of function related to cost, revenue and profit functions. **No of contact hours: 14**

UNIT-IV: Probability: Idea of Probability generating function and characteristic function and its utility in statistics. Random Experiments, sample space, events and algebra of events. Classical, statistical, and axiomatic of Probability. Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Random variables: discrete and continuous random variables. **No of contact hours: 13**

Course Learning Out comes: This course will enable the students to:

(i) Have knowledge and critical understanding, visualization, of basic concepts, terms of sets
(ii) Know about counting principle
(iii) Learn about relation and functions
(iv) Learn matrices and determinants, solving systems of linear equations through determinants
(v) Learn about derivative of different type of functions and application of derivative in economics
(vi) Know about sample spaces, basic ideas of probability and its application in practical problems

Text Books:

1. Seymour Lipschutz, Theory and problems of Set Theory and Related Topics, 2nd Edition, Schaum's Series, McGraw Hill, 1998.
2. C.E. Cullis, Matrices and Determinants, Vol 3, Cambridge University Press, 2013.
3. E. Haeussler, R. Paul and R. Wood, Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences, Pearson, 13th Edition, 2014
4. S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, S. Chand and Sons, 11th Ed 2002.

Reference Book:

1. A.M. Goon, M.K. Gupta and B. Dasgupta, Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata, 2002.
2. Irwin Miller Marylees Miller, John E. Freund's Mathematical Statistics with Applications, 8th Edition, Pearson 2014.