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FOUNDATION IN MATHEMATICS AND STATISTICS

Whatever way is chosen in order to define the contents of the courses of this programme, one cannot avoid the use of some elementary concepts of mathematics. That is why first 10 units of this course are devoted to introduce some mathematical terms used in the rest of the courses of this programme, in particular course MST-003. In fact having being 'Any graduate' as a qualification for this programme, it becomes necessary to think about those learners who don't have mathematical background after matriculation. Having these types of learners as a part of our target group, every care has been taken in order to define mathematical terms. Most of the mathematical terms are explained with the help of some practical/real life situations followed by a large number of examples. It is tried to avoid derivations of mathematical results unless otherwise it is necessary. The aim of this course, i.e. MST-001 (in particular first 10 units) is just to put the learners (in particular those having no mathematical background after matriculation) in a position, so that whenever these mathematical terms will be used, the basic idea can easily be grasped and feel comfortable. Last six units of this course are devoted to put a foundation stone for all other courses of the programme, i.e. elementary part of statistics such as defining statistics, development stages, very important concept of measurement of scales, methods of collection of data, classification, tabulation, diagrammatical and graphical presentation of data have been discussed in last six units of this course.

This course is divided into four blocks of four units each.

In **first block**, sets, functions and their various types are introduced. Arithmetic Progression (A.P.), Geometric Progression (G.P.), concept of summation, permutation and combination also have been discussed in this block. Brief introduction of binomial theorem is also included in this block.

The **second block** is devoted to concentrate on the four very much related and useful topics namely, limit, continuity, differentiation and integration. Concept of limit, continuity, differentiation, integration and some standard results on limit, differentiation and integration also have been discussed in this block.

The **third block** is devoted to the study of matrices and determinants, different types of matrices, and some simple properties of determinants. Origin, development, definition, scope, uses, limitations of statistics also has been briefly introduced. Measurement of scales—nominal, ordinal, interval and ratio are discussed in detail. Primary data, secondary data and their methods of collection are also discussed in detail.

Block four discusses classification, tabulation, diagrammatical presentation and graphical presentation of data. Box plot, stem and leaf plot are discussed in detail.

Although the material is self contained and self explained in nature. Even though if some learners are interested to gain more and want to study the contents in greater depth/more detail, it is a friendly advice for you to put a lot of practice to attempt all the exercises given in the relevant chapters of the below listed books.

1. Mathematics Textbook for Class XI, first addition (2006), reprinted December, 2009 (NCERT) (Chapters 1, 2, 7, 8, 9, 13)

2. Mathematics Textbook for Class XII, first edition (2006), reprinted December, 2009 (NCERT) (Chapters 1, 3, 4, 5, 6, 7)
3. SCHAUM'S OUTLINE OF Theory and Problems of Discrete Mathematics, Second Edition by Seymour Lipschutz and Marc Lars Lipson [Chapters 1, 3, 5, 6], Tata McGraw-Hill Publishing Company Limited
4. SCHAUM'S OUTLINE OF Theory and Problems of STATISTICS Third Edition by Murray R. Spiegel and Larry J. Stephens [Chapters 1, 2], Tata McGraw-Hill Publishing Company Limited
5. SCHAUM'S OUTLINE OF Theory and Problems of ELEMENTS OF STATISTICS Differential Statistics and Probability Third Edition by Stephen Bernstein and Ruth Bernstein [Chapters 6, 7], Tata McGraw-Hill Publishing Company Limited
6. Grinstead and Snell's 'Introduction to Probability, 2nd Edition', by Charles M. Grinstead and J. Laurie Snell, American Mathematical Society (2006) (Chapter 3)
7. Fundamentals of Mathematical Statistics by S.C. Gupta and V.K. Kapoor (1994), Sultan Chand & Sons (Chapter 1)
8. MARKETING RESEARCH An Applied Orientation, Sixth Edition (Chapter 10) by Naresh K. Malhotra and Satyabhusan Dash, Prentice Hall
9. Fundamentals of STATISTICS, volume one by A. M. Goon, M. K. Gupta, B. Dasgupta, Calcutta the world press private LTD. 1987 (Chapter 4, 5, 6)
10. BASIC STATISTICS, Fifth Edition, By B.L. Agarwal, New Age International (P) Limited, Publishers (Chapter 1, 2, 22)
11. Business Statistics by J. S. Chandan, Prof. Jagjit Singh and K. K. Khanna, Vikas Publishing House Pvt LTD, 1994 (Chapter 1, 3, 4)
12. Elements of Statistics (Part one) by B. N. Asthana, Chaitanya Publishing House, Allahabad, 1988 (Chapter 1, 2, 4, 5)
13. Fundamentals of Statistics by Late D. N. Elhance, Kitab Mahal, 1956, (Chapter 1, 3, 4, 5, 6)

Unit wise you may refer the books as given below:

Unit Number	Serial No of the Book	Unit Number	Serial No of the Book
1	1, 3	9	2, 3
2	1, 2, 3	10	2, 3
3	1	11	1, 7, 8, 9, 10, 11, 12, 13
4	1, 3, 6	12	8, 9, 10, 11, 13
5	1, 2	13	4, 9, 10, 11, 13
6	1, 2	14	4, 10, 13
7	2	15	4, 10, 12, 13
8	2	16	5

BLOCK 1 FUNDAMENTALS OF MATHEMATICS-I

This is the first block of the course MST-001. The aim of the block is to put a foundation stone for the next block of this course and will provide a platform to the learners (especially for non mathematical background) to understand the basic ideas of probability theory i.e. course MST-003. The flow of this block is maintained by the following four units.

Unit 1: Introduction to Sets

This unit will explain what we mean by sets, various types of sets, hierarchy of sets, different operations on sets, Venn-diagrams (i.e. pictorial representation of sets) and some simple applications of sets.

Unit 2: Functions

This unit will explain the very important term ‘function’ with the help of very good real life example of daughters and mothers in a very simple and logical way. Some particular and commonly used functions and three important and useful types one-one, onto, one-one correspondence of functions are also explained with the help of a number of examples. Geometrical interpretation of one-one, onto and one-one correspondence is also explained.

Unit 3: Progressions

This unit will throw the light on two very frequently encountered progressions known as Arithmetic Progression (A.P.) and Geometric Progression (G.P.).

How, n^{th} term and sum of first n terms of an A.P. or G.P. are evaluated, are explained with a variety and large number of examples. Some simple applications of A.P. and G.P. are also discussed. Concept of summation and formulae for the sum of some special sequences are also introduced. How these formulae are applied on numerical problems, is explained with the help of some examples.

Unit 4: Techniques of Counting

Last unit of this block is devoted to two very powerful techniques of counting, which provides us how many options/possibilities are there for a real life situation. Such as how many different sequences of answers of an objective type test are possible or how many different lottery numbers for a particular lottery are possible or how many different pin code of 4 digits can be provided to the customers of a particular bank. Binomial theorem is also introduced in this unit.

Notations and Symbols

$n(A)$: cardinality of the set A i.e. number of elements in the set A
\subseteq	: is a sub set of or is contained in
$A \Delta B$: symmetric difference of two sets A and B
${}^n P_r$: total number of permutations of n things taken r ($1 \leq r \leq n$) at a time
${}^n C_r$: total number of combinations of n things taken r ($1 \leq r \leq n$) at a time
\supseteq	: is a super set or contains
$\not\subseteq$: is not subset of or is not contained in
\subset	: is proper subset of
ϕ	: empty set or null set or void set
$P(A)$: power set of the set A
$l(I)$: length of the interval I
$f : X \rightarrow Y$: f is a function from X to Y
$ x $: modules of x or absolute value of x
A. P.	: arithmetic progressions
G. P.	: geometric progression
$\{a_n\}$: a sequence whose n^{th} term is a_n
a_n or t_n	: n^{th} term of an A. P. or G. P.
S_n	: sum of first n term of an A. P. or G. P.
$n!$ or \underline{n}	: n factorial
A^c or A'	: complement of the set A
(a, b)	: open interval
$[a, b]$: closed interval
$(a, b]$: left open and right closed interval
$[a, b)$: left closed and right open interval
\cup	: union
\cap	: intersection
\in	: belong to
\notin	: does not belong to
$=$: is equal to
\neq	: is not equal to
$<$: is less than
$>$: is greater than
\sim	: is equivalents to

Greek Alphabets

α	alpha	ψ	psi	π	pi
β	beta	ξ	xi	ρ	rho
$\gamma(\Gamma)$	gamma (cap. gamma)	η	eta	$\sigma(\Sigma)$	sigma (cap. sigma)
$\delta(\Delta)$	delta (cap. delta)	ζ	zeta	τ	tau
ε	epsilon	λ	lambda	χ	chi
i	iota	κ	kappa		
θ	theta	μ	mu	$\omega(\Omega)$	omega (cap. omega)
ϕ	phi	ν	nu		