MCA I Semester 1

Subject Name: Mathematics for Computer Science **Subject Code:** MTCA21109

Type of course: Basic Science Course

Prerequisite (if any):

- Elementary School Mathematics

List of Courses where this course will be prerequisite:

- RDBMS
- Data Structures
- Analysis of Algorithms
- Theory of Computation
- Cryptography
- Artificial Intelligence
- Data Science
- Machine Learning

Rationale: The objective of this course is to present the foundations of basic and statistical topics related to Computer Science that will be form basis for subjects like RDBMS, Data Structures, Analysis of Algorithms, Theory of Computation, Cryptography, Artificial Intelligence, Data Science, Machine Learning, to name a few. This course will enhance the student's ability to think logically and mathematically.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks		Practical Marks		Total
L	T	P	C	TEE	CAT	TEP	CAP	
3	1	0	4	60	40	-	-	100

CAT: Continuous Assessment Theory comprised of CA1 and CA2 **CA1:** Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CAP:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in courses.

Content:

Sr. No.	Content	Teaching Hrs.	Module Weightage
1	**Set Theory, Propositional & Predicate Logic** Set Theory : Basic Concepts of Set Theory: Definition, Two Methods to Describe (Represent) Sets: Examples, (Im)proper Subsets, Superset, Equality of Sets; Empty (Null) Set, Universal Set, Finite and Infinite Sets, Power Set; Operations on Sets: Union, Intersection, Complement, Venn Diagrams; Disjoint Sets, Various Laws: Identity, Idempotent, Commutative, Associative, Distributive, Absroption, DeMorgan; Difference (Relative Complement),Symmetric Difference of Two Sets; Cartesian Product; Power Set of a Set; Propositional Logic: Definition, Statement (Proposition) & Notation, Truth Values, Connectives: Negation, Conjunction, Disjunction, Implication (condition), Bi implication (Bi conditional), Truth Tables for all Connectives, Statement Formulas (Well-formed Formulas), Truth Tables, Tautologies, Contradiction, Logical Equivalence: Commutative Laws, Associative Laws, Distributive Laws, Absorption Laws, Idempotent Laws, Double Negation Law, DeMorgan's laws, Examples; Validity of Arguments, Some Valid Argument Forms: Modus Ponen s, Modus Tollens, Disjunctive Syllogism, Dilemma, Equivalence of Formulas: Conjunctive Simplification, Disjunctive Addition, Conjunctive Addition, Examples and Exercises;	10	25%
2	**Matrices** Introduction; Representation of a Matrix; Equality of Matrices; Special Matrices: Rectangular / Square Matrices, Null (Zero) Matrix, Unit Matrix, Diagonal Matrices, Triangular Matrices; Sum and Difference of 2 Matrices; Multiplication of 2 matrices; Transpose of a Matrix, Symmetric Matrices; Boolean (Zero One) Matrices, Boolean Join, Boolean Meet; Theorems and Exercises (without Proof)	6	15%
3	**Introduction to Data** Tabular and Graphical Displays Bar charts and Pie charts, Dot Plot, Histograms, Stem and Leaf Display, Cross tabulations, Scatter Diagram	4	15%

4	**Descriptive Statistics** Measures of Location: Mean, Weighted Mean, Median, Geometric Mean, Mode, Percentiles, Quartiles Measures of Variability: Range, Interquartile Range, Variance, Standard Deviation, Coefficient of Variation Distribution Shape, Five-Number Summary, Measures of association between two variables: Covariance, Correlation, Coefficient of Correlation;	8	15%
5	**Sampling Distributions and Hypotheses Testing** Selecting a sample, Point Estimation, Expected Value of x-bar, standard Deviation of x-bar, Central Limit Theorem; Estimating the Population Mean using z Statistic (σ Known); Estimating the Population Mean using the z Statistic when the Sample Size is Small; Estimating the Population Mean using t Statistic (σ Unknown); Estimating the Population Variance; Estimating Sample Size **Hypotheses Tests** Null and Alternate Hypotheses, Type I and Type II Errors, Testing Hypotheses about a Population Mean using z statistics and t statistics, Testing Hypotheses about a Variance	9	15%
6	**Linear Regression** Introduction, Simple Regression Model, Least Squares Method, Coefficient of Determination, the Equation of Regression Line; Residual Analysis for Validating Model Assumptions and Outliers	8	15%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	10	15	15	40	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of public ation	Publication Edition
1	Discrete Mathematics	D. S. Malik & M. K. Sen	Cengage Learning ISBN:978-8131518663	2012	1st Edition
2	Discrete Mathematics and its applications	K. H. Rosen	Tata McGraw-Hill ISBN:978-0073383095	2012	7th Edition
3	Business Statistics: Contemporary Decision Making	Ken Black	Wiley India Pvt Ltd ISBN: 978-8126521548	2009	5th Edition
4	Statistics for business and economics	Anderson, Sweeney, Williams, Camm, Cochran	Cengage Learning ISBN: 978-81-315-2813-6	2016	12th edition

Course Outcomes:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % Weightage
CO-1	Create a foundation of basic mathematical concepts of Set Theory, Propositional & Predicate Logic	25
CO-2	Understand and apply the concepts of matrices	15
CO-3	Produce exploratory graphs	15
CO-4	Apply various concepts, techniques and methods used in Descriptive Statistics and Inferential Statistics in carrying out preliminary Data Analytics tasks	15
CO-5	Understand the basic concepts of sampling distributions.	08
CO-6	Develop scientific hypotheses for application in computer science	07
CO-7	Apply linear regression models in practice and identify situation where linear regression is appropriate; build and fit linear regression models with software	15

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
CO-1	3	3	2	1	0	0	0	0	1	1	1	3	0
CO-2	3	3	2	1	0	0	0	0	1	1	1	3	0
CO-3	3	2	2	2	3	2	0	0	2	1	2	3	0
CO-4	3	3	3	3	3	2	1	2	2	1	2	3	0
CO-5	3	3	2	2	2	1	1	1	2	1	2	3	0
CO-6	3	3	2	3	2	2	1	1	2	1	1	3	0
CO-7	3	3	3	3	3	1	2	1	3	2	2	3	0
Rationale*													

Rationale*: Explaining why it is matching this particular program outcome

List of Open learning website:

- https://nptel.ac.in/courses/106/106/106106183/
  (NPTEL Course on Discrete Mathematics, Week 2)
- http://pfister.ee.duke.edu/courses/ece586/notes_ch1.pdf
  (Online notes on Logic and Set Theory)
- https://nptel.ac.in/courses/111/105/111105041/
  (NPTEL Course on Probability and Statistics, Modules 1, 8 and 9)

List of Open-Source Software: NA

Major Equipment Needed: NA