FYUGP Mathematical Sciences (Batch 2024 and Onwards)

Course Outline for Semester I (Batch 2024)

S. No.	Category	Course Code	Course Title	Credits	L	T	P	S	Hours per week
1	Major	MTHS100MJ	Foundation course in Mathematics	4	4	x	x	x	4
2	Minor 1		Students to choose	4					
4	Multidisciplinary		Student to choose	3	3	x	x	x	3
5	Ability Enhancement		Communication Skills	3	3	x	x	x	3
6	Skill Enhancement		Student to choose	2	3	x	x	x	3
7	Value-added		Digital and Technological Solutions	2	2	x	x	x	2
			Health and Wellness	2	2	x	x	x	2

Multidisciplinary: Choose any one course from Open basket, Business School or Humanities & Social Sciences basket
Skill: Choose any one course from the list of skill courses

S. No.	Name of the Course	Department offering the Course
	Skill Courses:	
1	Fruit and Vegetable Processing Technologies	Department of Food Technology
2	Multimedia Editing	Department of Journalism and Mass Comm.
3	Workshop Technologies	Central Workshop
4	Refrigeration AC Conditioning	Department of Mechanical Engineering
5	Health Care Skills	Centre for Ayush Science
	Multidisciplinary Courses:	
A)	**Open Basket**	
1	Statistics	Department of Mathematical Scineces
2	Generative AI	Centre for AI
3	Exploring Neighbourhood with Space Technologies	Department of Planning and Geomatics
B)	**Humanities & Social Sciences Basket**	
1	Lessons from History	Department of Political Sciences/IR
C)	**Business School Basket**	
1	Principles of Economics	Department of Economics

Course Title: Foundation course in Mathematics Course	L	T	P	S	Semester: 1st
Course Code: MTHS100MJ	4	x	x	x	Max Marks: 100
Credits: 4					

Course Objective: To provide a foundational understanding of algebra and matrix theory, equipping students with the essential mathematical concepts required for basic sciences, data science, artificial intelligence and advanced coursework in the program.

Course Outcomes: After the end of this course students will be able to

1. Apply set theory and functions to model and analyze real-life situations, construct Venn diagrams and mapping diagrams and interpret linear and quadratic functions using graphical and computational tools.
2. Apply counting principles, algebraic identities and linear equations and inequalities to solve real-life problems using analytical, graphical and collaborative approaches.
3. Classify and analyze matrices and determinants, understand special matrix types and their properties and apply these concepts to real-life data and problem-solving.
4. Analyze and evaluate logical statements using connectives, truth tables and logical laws to model and solve reasoning problems.

Unit-I: Review of sets and operations through real-life surveys and group activities, construct and interpret Venn diagrams to illustrate set identities, subset relationships and syllogistic arguments. Simulate Cartesian products using pairing activities and grid representation. Model relations with real-life examples (e.g., student–subject preferences) and classify them, demonstrate functions with mapping diagrams and input-output activities, Role-play to understand types of functions: one-one, onto and bijective, Identify domain, co-domain and range through hands-on exercises, collect and analyse data to explore real-valued functions, Plot and interpret linear and quadratic models using graph paper or Excel, or Python, apply models to real-world contexts such as cost, profit and growth.

Unit II: Introduction to counting principles, counting principles through games, puzzles, and real-life arrangements, permutation and combinations, apply permutations and combinations in classroom activities like seating plans and team selections, binomial theorem, algebra and algebraic identities by modeling patterns and verifying identities through activities, Linear equations in one and two variables will be solved using role-play situations (age, distance or cost problems), while linear inequalities and their graphical representations will be learned through hands-on plotting tasks, systems of linear equations and inequalities (up to three variables) using collaborative problem-solving and real-world applications like budgeting and resource allocation.

Unit III: Review of matrices and determinants, classify matrices by creating examples from real-life data (student marks, timetable, seating plan), Perform operations on matrices created from real data (attendance, expenses), solve puzzles and geometric problems (e.g., area of triangle using determinants), generalization of reversal law of transpose, symmetric, skew symmetric, Hermitian and skew- Hermitian matrices, Representation of a square matrix as $P + iQ$, where P and Q are both Hermitian, Adjoint of a matrix, For a square matrix A, $A(adjA) = (adjA)A = |A|I$. Commutative and associative laws in matrix operations. Necessary and sufficient condition for a square matrix to be invertible. Generalization of reversal law for the inverse of matrices under multiplication.

Unit-IV: Introduction to logic, statements and propositions, logical connectives, conjunction (AND), disjunction (OR), negation (NOT), implication (IF-THEN), Biconditional (IF AND ONLY IF), truth tables, logical equivalences and laws (De Morgan's laws, distributive laws, associative laws, tautologies and contradictions).

Textbooks/Reference:

1. Ajit Kumar, S. Kumaresan and B. K. Sarma, A Foundation Course in Mathematics, Alpha Science International Ltd. Oxford, U.K, 2018
2. Shanti Narayan, A textbook of Matrices, Schaum S. Chand and Company, 1957.
3. S. Lipschutz & M. Lipson, Linear Algebra, Schaum's outline series, Tata McGraw-Hill, 4th Edition 2009..
4. S. Lipschutz & M. Lipson, Theory and Problems of Discrete Mathematics, Schaum"s outline series, Tata McGraw-Hill, Third Edition 2009.