K.T.S.P. Mandal's
Hutatma Rajguru Mahavidyalaya, Rajgurunagar
Department of Mathematics
Programme Specific Outcome and Course outcome

Programme Specific Outcome:

PSO 1:   Give the students a sufficient knowledge of fundamental principles, methods and a clear perception of innumerous power of mathematical ideas and tools and know how to use them by modeling, solving and interpreting.

PSO 2:   To equip the students sufficiently in both analytical and computational skills in Mathematical Sciences.

PSO 3:   To develop a competitive attitude for building a strong academic - industrial collaboration, with focus on continuous learning skills.

PSO 4:   Enhancing students overall development and to equip them with mathematical modeling abilities, problem solving skills, creative talent and power of communication necessary for various kinds of employment.

PSO 5:   Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.

PSO 6:   Enabling students to Gauge the hypothesis, theories, techniques and proofs provisionally.

Course Outcome:

Class	Sem	Paper	Subject	Course Outcome
F. Y. B. Sc.	I	Maths-I MT-111	Algebra	By the end of this course students will able to CO1 : Using Euclidean Algorithm find the GCD , also example based on mathematical inductions. CO2:Find inverse of function, also examples based on equivalence relation. CO3: find the congruence relation CO4 : Perform the basic operation on complex number, also find the conjugate, modulus and argument of complex number. also find the nth root of the unity.

				CO5 : Know the definition functions ,one-one function, onto function, inverse function
				CO6 : use of Fermat's theorem to find the remainder
F. Y. B. Sc.	I	Maths-II MT-112	Calculus I	CO1 : Know properties of real numbers. Also know the Absolute value.
				CO2 : Know the definition of sequence, the limit of sequence, limit theorems
				CO3 :Know the concept of convergent sequence, Divergent sequence, Monotone sequence, Oscillatory sequence, Subsequence, Bolzano-Weierstrass theorem, Divergence Criteria.
				CO4 : Know the definition of function , Find the domain and range of function and their graphs.
				CO5 : Types of functions with graphs
				CO6: Definition of limit of function , Cluster point, examples based on ϵ-δ definition of limit.
				CO7 : Sequential criteria for limits ,Divergence criteria.
				CO8 : Know the left hand limit and right hand limit, infinite limits.
				CO9 : Know the definition of continuous function , sequential criterion for continuity, Discontinuity criterion
				CO10: know the concept of Combination of continuous functions, also composition of continuous functions, continuous functions on intervals
				CO11: Know the examples of continuous functions , Bolzano's Intermediate value theorem.
F. Y. B. Sc.	I	Maths-III MT-113	Practical	CO1:Know the Operators with Description, Also Assign the numbers by using maxima
				CO2 : Assign the sets ,also find the set operation such as union, intersection,

				difference, complement ,cardinality of sets, power sets ,equal sets, subsets ,partitions of sets ,Cartesian product by using maxima software.
				CO3: Find the GCD and LCM ,divisors of integers ,find the remainder by using maxima: Find the square root of integers ,also find the angle of trigonometric functions by using maxima software.
				CO4: Find the addition, subtraction ,multiplication ,conjugate, real and imaginary part, modulus, argument of complex number by using maxima.
				CO5: Computing limit of function ,also graphically show that the function is continuous or not by using maxima, also find the terms of the sequence and discuss the convergence of the sequence by using maxima software.
				CO6:Using Euclidean Algorithm find the GCD , also example based on mathematical inductions.
				CO7:Find inverse of function, also examples based on equivalence relation.
				CO8: Perform the basic operation on complex number, also find the conjugate, modulus and argument of complex number. also find the nth root of the unity.
				CO9:Discuss the continuity of the function, also prove that a function is continuous at a point by using sequential criterion.
				CO10:Example based on ϵ-δ definition, Evaluating the limit of function.
				CO11: Find the supremum and infimum of the set,
				CO12: Using the limit of sequence to show that sequence has limit, or discuss the convergence of sequence also find the

				limit of the sequence.
F. Y. B. Sc.	II	Maths-I MT-121	Analytical Geometry	CO1 : Change of axes-Translation of axes and Rotation of Axes. Also know that equation for translation and equation for rotation .
				CO2 : Know that General equation of second degree in two variables.
				CO3 : Know that the types of conic section such as An Ellipse, An Hyperbola ,An Parabola. Also must know the standard equation of Ellipse, Parabola, Hyperbola.
				CO4 : Determine the Nature of Conics. Also Find the Centre of Conics.
				CO5 : Translate and rotate the axes and reduce the conic to standard form.
				CO6: Find the Direction Ratios and Direction cosines, Also know the Relation between d. r. s. and d. c. s.
				CO7 : Find the equation of plane , Normal form, transform to the normal form, plane passing through three non-collinear points ,intercept form, angle between two planes.
				CO8 : Know the Distance of a point from a plane ,distance between parallel planes ,two sides of planes, bisector planes.
				CO9 : Find equation of line in symmetrical and unsymmetrical forms, line passing through two points, angle between a line and a plane.
				CO10:Know the Perpendicular distance of a point from a plane, condition of coplanarity.
				CO11: Know the equation of sphere in different form, plane section of sphere ,Equation of circle, sphere through a given circle.
				CO12: Find the intersection of a sphere and line, equation of tangent plane to

				sphere.
F. Y. B. Sc.	II	Maths-II MT-122	Calculus II	CO1 :Know the definition of the derivative of a function at a point, every differential function is continuous, rules of differentiation, the chain rule, Derivative of inverse function. CO2 : The Mean value theorems and Roll's theorem, Cauchy mean value theorem. CO3 : Know the L Hospital Rule , Taylor theorem , Maclaurin's theorem with Lagrange's form of remainder. CO4 : Know that the successive differentiation, Also know the nth derivative and Leibnitz theorem for successive differentiation CO5 : Ordinary Differential Equations CO6: Know the Linear first order equations , separable equations CO7: Existence and Uniqueness of solution of nonlinear equations. CO8 :Know the definition of Exact differential equations,. CO9 : Find the transformation of nonlinear equations to separable equations. CO10: Find the Integrating factor
F. Y. B. Sc.	II	Maths-III MT-123	Practical	CO1:Determine the nature of the conics by using maxima .also assign the co-ordinates CO2: Draw the plane ,use maxima to find equation of plane passing through three points, also using maxima to show any four points are coplanar. CO3:use maxima to find in symmetrical form of equation of line also find the equation of sphere passing through the points by using maxima, also show that the points are concyclic. CO4:Find the derivative of a function by using maxima also find the derivative by

				chain rule in maxima, also verify the Mean value theorem and Roll's theorem by using maxima, also find Taylor series expansion in maxima CO5:Find the integrating factor using maxima for differential equation to be exact, also determine the given differential function are exact by using maxima, plot the direction field using maxima software. CO7:Example based on Translate and rotate the axes and reduce the conic to standard form. CO8:Examples based on coplanarity, also find the equation of plane passing through the three points. CO9:Obtain the symmetrical form of the equation of line, example based on equation of tangent plane also find the equation of sphere having the circle as great circle. CO10:Calculating the derivative of the functions ,also verify the Mean value ,thm,Roll's value ,Cauchy thm.
F. Y. B. Sc. (Comp. Sci.)	I	Maths I MT-111	Matrix Algebra	CO1 : perform matrix operations CO2 : find the inverse of a matrix CO3 : Obtain row reduction and echelon forms, vector equations CO4 : obtain solution set of linear system CO5 : find partitioned matrices, LU decomposition CO6 : find linear independent vector, the matrix of linear transformation CO7 :find dimension and rank CO8: find the solutions of linear equations by sing cramer's rule , volume and linear transformations
F. Y. B. Sc. (Comp. Sci.)	I	Maths II MTC-112	Discrete Mathematics	CO1 : Know the Propositional Logic, Logical Connectives, Propositional Equivalence.

				CO2 : Predicate, *n*-Place and *n*-ary . CO3 : Identify Universal Quantifier, Existential Quantifier. CO4 : Know the Rules of Inference. CO5 : Types of Relations, Representation of Relations CO6 : Draw Hasse diagram. CO7 : Distinguish between Complemented lattice, Bounded lattice and Distributive lattice. CO8: Transitive Closure and Warshall's Algorithm CO9: Understand Boolean function, Represent Boolean function. CO10 : Understand the Inclusion-Exclusion Principle and Pigeonhole Principle. CO11 : Use Permutation and combination. CO12 : Use Recurrence Relations to find homogeneous solution, Solving Recurrence Relation, particular and total solution.
F. Y. B. Sc. (Comp. Sci.)	I	Maths III MTC-113	Practical	CO1 : Show equivalence by using maxima software CO2 : Find adjacency and incidency matrix by using maxima software . CO3 : Find Conjunctive Normal Form and Disjunctive Normal Form by using maxima software . CO4 : Simplify the boolean expressions by using maxima. CO5: By using maxima software determine permutation and combination. CO5 : Solve the recurrence relation by using maxima software. CO6: Know the operation on matrices by using maxima software . CO7 : Find Column space ,Null space ,Rank and Nullity of matrix by using

				maxima software . C08 : Know the Propositional equivalence ,predicates and quantifiers ,Rules of inference CO9 : Find transitive closure by Warshall's algorithm, know the properties of lattices ,and types of lattices, boolean variable and boolean function CO10 : Know the Inclusion - Exclusion principle , Pigeonhole principle , Permutation and combination CO11 : Solve homogeneous and non homogeneous recurrence relation CO12 : Characterization of invertible matrices ,method of solving linear system ,Row reduction and Echelon forms CO13 : Introduction to Linear transformation , Matrix of linear transformation , properties of determinants, Cramer's rule ,volume and linear transformation .
F. Y. B. Sc. (Comp. Sci.)	II	Maths I MTC-121	Linear Algebra	CO1 : understand vector spaces and subspaces CO 2 : Find Null spaces ,column spaces CO3 : Find Linearly independent sets and basis for vector spaces CO4: Obtain eigenvalues and eigenvectors ,characteristic equation CO5: perform diagonalization of matrices , linear transformations CO6: find inner product , length and orthogonality ,orthogonal sets, Orthogonal projections, Quadratic forms CO7 : Find affine Combinations, Affine independence convex combinations
F. Y. B. Sc. (Comp. Sci.)	II	Maths II MTC-122	Graph Theory	CO1: Understand basic terminologies and results of Graphs, Graphs models. CO2 : Know the types of Graphs ,Types of

				the Diagraphs, Isomorphism of the Graphs
				CO3 : Calculate Adjacency and Incidence Matrix of a Graph.
				CO4 : Find subgraphs, induced subgraphs of graph.
				CO5 : Know the Elementary properties of the Connectedness.
				CO6 : Perform vertex deletion and edge deletion operation on graph. Counting paths between vertices.
				CO7 : Find the shortest path by Dijkstra's Algorithm.
				CO8 : Understand various properties of connected graph, tree and Eulerian and Hamiltonian Graphs.
				CO9 : Know the Konigsberg bridge problem , Fluery's Algorithm
				CO10 : Find the shortest path by travelling salesman problem, Chinese Postman Problem .
				CO11: Understand the concept of union, intersection, product and complement of graph.
				CO12 : Understand basic terminologies, Properties and applications of trees
				CO13 : Find the shortest path using Kruskal's Algorithm and Prim's Algorithm
F. Y. B. Sc. (Comp. Sci.)	II	Maths III MTC-123	Practical	CO1 : Find the Matrix representation and elementary result , isomorphism of graphs ,application of special types of graphs.
				C02 : Shortest path problems , Dijkstra's algorithm
				CO3 : Find Eulerian path , Hamiltonian path , Travelling salesman problem ,Chinese Postman Problem .
				CO4 : Examples based on the linearly independence and dependence ,Find basis and dimension of null space , Find the bases for the subspace spanned by the vectors

				CO5 : Find the eigen values and eigen vectors of the matrix, Know the diagonalization process .
				CO6 : Know the Gram Schmidt process , Orthogonality and symmetric matrices
				CO7 : Know the Affine combination , Affine independence and convex combination
				CO8 : Find the number of vertices ,degree of each vertex ,minimum and maximum degree vertex ,minimum and maximum degree vertex by using maxima software
				CO9 : Identify the types of graphs, Show graph Isomorphism by using maxima software . Determine graphs are connected or not by busing maxima software .
				CO10 : Find the edge connectivity ,vertex connectivity ,Hamilton path and Hamilton cycle by using Maxima software.
				CO11 :Find column space and null space ,eigen values and eigen vectors by using maxima software.
				CO12 :Diagonalize the matrices by using Maxima Software. Compute inner product ,length of the vectors by using maxima software . Determine sets of vectors are orthogonal or orthonormal by using maxima software .
F.Y.B.B.A. (C.A.)	II	CA-203	Business Mathematics	CO1 : Solve basic problems based on gcd ,ratio ,proportion etc.
				CO2 : Solve problems of Profit, Loss , simple interest ,compound interest.
				CO3 : Know about shares and annuity.
				CO4 : Know about matrices and algebra of matrices such as addition subtraction, multiplication , scalar multiplication.
				CO5 : Find the Inverse of the matrix by adjoint method.

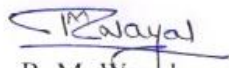|				
				CO6 : Know the Linear programming problem , graphical method and Formulation of LPP. CO7 : Solve the transportation problem, North West Corner Method , Least Cost Entry Method , Vogel's Approximation Method.
S.Y.B.Sc.	I	Maths I MT -231	Calculus Of Several Variables	CO1 : Find the domain and range of multivariable function. CO2 : Find level curve and plot a graph of function. CO3 : Find simultaneous and repeated limits. CO4 : Calculate partial derivative of higher order. CO5 : Know the concept of differentiability, apply chain rule . CO6 : Apply Lagrange's method for finding extreme vales. CO7 : Calculate Double and triple integral and find area and volume of different surfaces
S.Y.B.Sc.	I	Maths II MT-232(A)	Numerical Methods And It's Applications	CO1 : Rounding off number to n significant digits and n decimal places. CO2 : Calculate absolute, relative and percentage error. CO3 : Apply Bisection, False position, Newton Raphson and iteration methods for finding approximate solution. CO4 : Know the finite difference operators and their relations. CO5 : Apply Newton forward difference, Backward difference interpolation, Lagrange's interpolation and Newton divided difference formulae. CO6 : Feet straight line, quadratic equation, power function and exponential function. CO7 : Use Trapezoidal rule, Simpson's $(1/3)^{rd}$ and Simpson's $(3/8)^{th}$ rule.

				CO8 : Find numerical solution of differential equation by using Euler's method , modified Euler's method and Runge Kutta methods.
S.Y.B.Sc.	II	Maths I MT-241	Linear Algebra	CO1 : Reduce the matrix to row echelon form and solve the system of linear equations. CO2 : Know the concept of Vector Space, subspace , linear dependence and independence. CO2 : Check whether given set is basis or not of vector space. CO3 : Find basis for row space, column space, null space. CO6 : Check linear transformation of function CO7 : Calculate rank and nullity of linear transformation. CO8 : Find inverse of linear transformation and matrix of linear transformation. CO9 : Know the basic matrix transformation in R^2 and R^3.
S.Y.B.Sc.	II	Maths II MT-242	Vector Calculus	CO1 : Calculate limit, continuity, derivative and integration of vector valued function. CO2 : Find Arc Length along curve, speed on a smooth curve and tangent vector. CO3 : Evaluate line integral of vector fields. CO4 : Find work done, flow integrals, circulation for vector field. CO5 : Apply Divergence theorem and Green's theorem. CO6 : Calculate surface integrals of vector fields. CO7 : Apply Stokes' theorem and find Curl and Divergence of vector field.
S.Y.B.Sc.	I	Maths I	Group	CO1 : Know the division algorithm ,

(Comp. Sci.)		MTC-231	and Coding Theory	G.C.D using division algorithm and expressing it as linear combination. CO2 : Understand Euclid's Lemma . CO3 : Identify Equivalence relation , Congruence relation, on set of integers, Equivalence class partition . CO4 : Know the definition of binary operation ,group and elementary properties of group. CO5 : Know the definition of subgroup ,examples ($(Z_n, +)$ and $(U(n),)$, order of group , order of an element . CO6 : Find order of group , order of an element. CO7 : Distinguish between Group and Subgroup. CO8: Identify the permutation group ,cyclic group, finding generators of Z_n. CO9: Understand definition and examples of cosets , Lagrange Theorem.
S.Y.B.Sc. (Comp. Sci.)	I	Maths II MTC-232	Numerical Technique	CO1 : Rounding off number to n significant digits and n decimal places. CO2 : Calculate absolute, relative and percentage error. CO3 : Apply Bisection, False position, Newton Raphson and iteration methods for finding approximate solution. CO4 : Know the finite difference operators and their relations. CO5 : Apply Newton forward difference, Backward difference interpolation, Lagrange's interpolation and Newton divided difference formulae. CO6 : Use Trapezoidal rule, Simpson's $(1/3)^{rd}$ and Simpson's $(3/8)^{th}$ rule. CO7 : Find numerical solution of differential equation by using Euler's method , modified Euler's method and Runge Kutta methods.
S.Y.B.Sc.	II	Maths I	Computat	CO1: Understand basic terminologies and

| (Comp. Sci.) | | MTC-241 | ional Geometry | representation of points, transformation and matrices. CO2 : Know the transformation of points , straight lines, mid-point, parallel lines , intersecting lines . CO3 : Know the transformations : rotations, reflections, scaling ,shearing. CO4 : Find transformation of unit square ,solid body transformation , CO5 : Find the translations and homogeneous co-ordinate. CO6 : Perform multiple transformations. CO7 : Find the three dimensional - scaling ,shearing, rotation, reflection ,translation . CO8 :Understand the rotation about- an axis parallel to co-ordinate axis, an arbitrary line . CO9 : Know reflection through- co-ordinate planes, planes parallel to co-ordinate planes, arbitrary plane CO10 : Identify the types of projection : Orthographic projection ,Axonometric projection, Oblique projection, Single-point perspective projection . CO11: Understand the concept of curve presentation and parametric presentation CO12 : Understand parametric representation of circle and generation of circle. CO13 :Understand the definition and properties of the Bezier curve and equation of the curve in matrix form(up to n=3). |
| S.Y.B.Sc. (Comp. Sci.) | II | Maths II MTC-242 | Operation Research | CO1 : Use graphical method to solve LPP, CO2 : Apply simplex method, understand the concept of surplus variable , slack variable and artificial variable. CO3 : convert the problem in dual form. CO4 : Solve the transportation problem by |

				using North west corner method , matrix minima method , VAM etc. CO5 : Solve assignment problem by Hungarian method

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