ST JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS)

VISAKHAPATNAM

DEPARTMENT OF MATHEMATICS

The Department of Mathematics, St. Joseph's College for Women (A) seeks to serve BSc Programme students interested in careers related to Mathematics. The department offers Mathematics in four core combinations MPC, MPCs, MEC and MStCs of BSc programme. In order to cater to the diverse interests of students and employers, a total of 10 theory and 10 practical courses are offered as part of Mathematics domain in all the four combinations.

Programme Specific Outcomes of BSc Programme with Mathematics

PSO 1: To inculcate the concepts and applications of Differential Equations, Solid Geometry, Abstract Algebra, Real Analysis, Ring Theory and Vector Calculus, Linear Algebra and Numerical Analysis, Integral Transforms, Advanced Numerical Analysis and Special Functions.

PSO 2: Be able to apply theoretical / analytical / statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during practical's and draw meaningful solutions to day to day problems like traffic management.

PSO 3: Be able to access, explore an area to obtain information and use the literature in Mathematics and also able to work as a member of a team.

PSO 4: Be able to integrate knowledge gained in Mathematics to General education courses like Analytical Skills.

Assessment Methodology

PSO 1: To inculcate the concepts and applications of Differential Equations, Solid Geometry, Abstract Algebra, Real Analysis, Ring Theory and Vector Calculus, Linear Algebra and Numerical Analysis, Integral Transforms, Advanced Numerical Analysis and Special Functions

Direct method of computing PSO 1 attainment is based on the student performance in all assessment instruments namely online and offline - subjective and objective tests for all the courses offered (M1301, M2301, M3301, M4301, M5301, M5302, M6301, $ME_1$6301, $MA_1$6301, $MA_2$6302, $MA_3$6303, $MB_1$6301, $MB_2$6302, $MB_3$6303). These exams test students' learning at knowledge, understanding and application levels in the respective courses. Indirect method of

computing PSOs is done through students' course exit survey wherein a structured questionnaire is administered to the students and their response is solicited on a 5 point scale. Responses are consolidated and students' satisfaction level with reference to course transaction is computed.

Level of attainment measurement

Level of attainment of course outcomes includes both direct and indirect assessments. Direct assessment is done by testing the knowledge and/or skills of the student in that course by conducting standardised examinations. In indirect assessment we use the student feedback on course which is measured on 5 point scale. The sum of these two assessments is shown as the level of attainment of that course.

Assessment of all the theory courses is done in two parts, namely by formative assessment (40%**)** which is internal and summative assessment (60%) which is external**.** The evaluation of 100% of the assessment in each semester is distributed as follows:

Mid Semester Examination 1	15% (which is offline)
Mid Semester Examination 2	15% (which is online)
Accessory Assessment	5% (written quiz, Assignment etc.)
Attendance	5% (above 75% attendance will be rewarded)
End semester examination	60% (which is descriptive)

Level of attainment of PSO1 (all theory courses offered by the department): 81%

PSO 2: Be able to apply theoretical / analytical / statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during Practical's and draw meaningful solutions to day to day problems like traffic management.

PSO 2 attainment level is ascertained based on internal assessment (mid semester) and summative assessment (end semester) in every semester. This direct assessment involves application of knowledge in solving / analyzing /exploring a real life situation / difficult problems and also testing students' knowledge.

Assessment of all the practical courses: Assessment is done in two parts, namely by continuous assessment (40%**)** and summative assessment (60%). In internal assessment, will be assessed for 40% by the practical application knowledge. Summative assessment (60%) of

practical courses is through end semester practical exams designed to test student's knowledge as well as skills in the conduct of practicals. This direct assessment involves application of knowledge in solving / analyzing /exploring a real life situation / difficult problems and also testing students' knowledge. Average percentage of level of attainments of all the practical courses in Mathematics is given below. A written record of practical work carried out throughout the semester is also assessed.

Level of attainment PSO2 (all practical courses offered by the department): 86%

PSO 3: Be able to access, explore an area to obtain information and use the literature in Mathematics and also able to work as a member of a team.

Assessment of Project work: This project work provides an opportunity for the student to apply knowledge and skills obtained in Mathematics theory and practical coursework. From a list of relevant application level topics provided by the dept., Students choose one topic for study, based on their own interest. Like minded students form teams of $2 \leq x \leq 5$ where x is a group (a group consist of minimum 2 and maximum 5) in V semester as a part of accessory examination for 10 marks and plan & execute the task. The study is followed by collective report submission and individual oral presentation. Attainment of this learning outcome is ensured and assessed by the concerned faculty member at every stage through direct as well as indirect guidance and monitoring.

Level of attainment of PSO3 (projects done by the students in V Semester): 86%

PSO 4: Be able to integrate knowledge gained in Mathematics to General education courses.

Assessment of this learning outcome is largely done through the undergraduate general education course namely Analytical Skills. This course provides an opportunity for the students to apply Mathematical knowledge to ability to visualize, gather information, articulate, analyze and solve complex problems. Analyze the data from the information collected, and come up with a solution to a problem. Easily to attempt all types of competitive exams. Direct method of computing

PSO 4 attainment is based on the student performance in all assessment instruments namely formative (Online) and summative tests (Online) in courses on Analytical Skills.

Assessment of Analytical Skills: The evaluation of 100% of the assessment in Analytical Skills is distributed as follows:

Continuous assessment: 30% (which is online)

Participation & Involvement in the course: 10% (above 75% attendance will be rewarded)

End semester examination: 60% (which is also online)

Level of attainment of PSO4 (Analytical skills offered by the college): 80%

Course outcomes of all the courses offered by Mathematics department

Code	Title of the paper	Outcomes
M1301 (Th.)	Differential Equations	**Students will able to** **CO1:** Extract the solution of differential equations of the first order and of the first degree by variables separable, Homogeneous and Non-Homogeneous methods. **CO2:** Find a solution of differential equations of the first order and of a degree higher than the first by using methods of solvable for p, x and y. **CO3:** Compute all the solutions of second and higher order linear differential equations with constant coefficients, linear equations with variable coefficients. **CO4:** Solve simultaneous linear equations with constant coefficients and total differential equations. **CO5:** Form partial differential equations. **CO6:** Find the solution of First order partial differential equations for some standard types. **CO7:** Use inverse Laplace transform to return familiar functions **CO8:** Apply Laplace transform to solve second order linear differential equation and simultaneous linear differential equations. **CO9:** Compute all the solutions of Orthogonal Trajectories **CO10:** Compute all the solutions of Higher Order Linear Differential Equations with Constant Coefficients and non Constant Coefficients
Level of attainment of CO1 to CO10: 77%		
M1351 (Pr.)	Differential Equations	**Students be able to apply theoretical / analytical / statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during Practicals and draw**

		meaningful solutions to day to day problems **CO1:** Extract the solution of differential equations of the first order and of the first degree by variables separable, Homogeneous and Non-Homogeneous methods. **CO2:** Find a solution of differential equations of the first order and of a degree higher than the first by using methods of solvable for p, x and y. **CO3:** Compute all the solutions of second and higher order linear differential equations with constant coefficients, linear equations with variable coefficients. **CO4:** Solve simultaneous linear equations with constant coefficients and total differential equations. **CO5:** Form partial differential equations. **CO6:** Find the solution of First order partial differential equations for some standard types. **CO7:** Use inverse Laplace transform to return familiar functions **CO8:** Apply Laplace transform to solve second order linear differential equation and simultaneous linear differential equations. **CO9:** Compute all the solutions of Orthogonal Trajectories **CO10:** Compute all the solutions of Higher Order Linear Differential Equations with Constant Coefficients and
Level of attainment of CO1 to CO10: 84%		
M2301 (Tr.)	Solid Geometry	**Students will able to** **Co1:** Describe the various forms of equation of a plane, straight line, Sphere, Cone and Cylinder. **CO2:** Find the angle between planes, Bisector planes, Perpendicular distance from a point to a plane, Image of a line on a plane, Intersection of two lines **CO3:**Define coplanar lines and illustrate **CO4:** Compute the angle between a line and a plane, length of perpendicular from a point to a line **CO5:** Define skew lines **CO6:** Calculate the Shortest distance between two skew lines **CO7:** To inculcate knowledge on solve problems in analytic

		geometry and able to find appropriate solutions for given problems **CO8:** Geometry for the realistic look to the landscape and the characters that inhabit the virtual world. **CO9:** Besides helping computer designers build virtual realities, geometry's applications in the real world include Architecture, Computer-aided manufacturing, medicine, biology, physical sciences and much more **CO10:** Design for construction blueprints
Level of attainment of CO1 to CO10: 84%		
M2351 (Pr.)	Solid Geometry	**Students be able to apply theoretical / analytical / statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during Practicals and draw meaningful solutions to day to day problems** **Co1:** Describe the various forms of equation of a plane, straight line, Sphere, Cone and Cylinder. **CO2:** Find the angle between planes, Bisector planes, Perpendicular distance from a point to a plane, Image of a line on a plane, Intersection of two lines **CO3:**Define coplanar lines and illustrate **CO4:** Compute the angle between a line and a plane, length of perpendicular from a point to a line **CO5:** Define skew lines **CO6:** Calculate the Shortest distance between two skew lines **CO7:** To inculcate knowledge on solve problems in analytic geometry and able to find appropriate solutions for given problems **CO8:** Geometry for the realistic look to the landscape and the characters that inhabit the virtual world. **CO9:** Besides helping computer designers build virtual realities, geometry's applications in the real world include Architecture, Computer-aided manufacturing, medicine, biology, physical sciences and much more **CO10:** Design for construction blueprints
Level of attainment of CO1 to CO10: 86%		

M3301 (Th.)	Abstract Algebra (Number theory and Group Theory)	**Students will able to** **CO1**: Illustrate the Division and Euclidean Algorithm **CO2:** Describe the properties of prime numbers **CO3:** Show that every positive integer can be expressed as product of prime power in unique way **CO4:** Write a formula for the number of positive integers less than n that are relatively prime to n **CO5:** Define congruences and describe the properties of congruences **CO6:** Find the Sum, product of all the divisiors of N. **CO7:** Find the smallest number with N divisors. **CO8:** Solve the system of linear congruences **CO9:** Fermat's and Wilson's theorem **CO10:** Group theory has a huge number of applications in the real world
Level of attainment of CO1 to CO10: 87%		
M3351 (Pr.)	Abstract Algebra (Number theory and Group Theory)	**Students be able to apply theoretical / analytical / statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during Practicals and draw meaningful solutions to day to day problems** **CO1**: Illustrate the Division and Euclidean Algorithm **CO2:** Describe the properties of prime numbers **CO3:** Show that every positive integer can be expressed as product of prime power in unique way **CO4:** Write a formula for the number of positive integers less than n that are relatively prime to n **CO5:** Define congruences and describe the properties of congruences **CO6:** Find the Sum, product of all the divisiors of N. **CO7:** Find the smallest number with N divisors. **CO8:** Solve the system of linear congruences **CO9:** Fermat's and Wilson's theorem **CO10:** Group theory has a huge number of applications in the real world

Level of attainment of CO1 to CO10: 87%		
M4301 (Th.)	Real Analysis	**Students will able to** **CO1:** Define different types of sequences. **CO2:** Discuss the 8ehavior of the geometric sequence. **CO3:** Prove properties of convergent and divergent sequence. **CO4:** Verify the given sequence in convergent and divergent by using 8ehavior of Monotonic sequence. **CO5:** Prove Cauchy's first limit theorem, Cesaro's theorem, Cauchy's Second limit theorem. **CO6:** Explain subsequences and upper and lower limits of a sequence. **CO7:** Give examples for convergence, divergence and oscillating series. **CO8:** Discuss the 8ehavior of the geometric series. **CO9:** Prove theorems on different test of convergence and divergence of a series of positive terms. **CO10:** Verify the given series is convergent or divergent by using different test and To inculcate knowledge on real numbers and their properties & proofs.
Level of attainment of CO1 to CO10: 77%		
M4351 (Pr.)	Real Analysis	**Students be able to apply theoretical / analytical / statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during Practicals and draw meaningful solutions to day to day problems** **CO1:** Define different types of sequences. **CO2:** Discuss the 8ehavior of the geometric sequence. **CO3:** Prove properties of convergent and divergent sequence. **CO4:** Verify the given sequence in convergent and divergent by using 8ehavior of Monotonic sequence. **CO5:** Prove Cauchy's first limit theorem, Cesaro's theorem, Cauchy's Second limit theorem. **CO6:** Explain subsequences and upper and lower limits of a sequence.

		CO7: Give examples for convergence, divergence and oscillating series. **CO8:** Discuss the behavior of the geometric series. **CO9:** Prove theorems on different test of convergence and divergence of a series of positive terms. **CO10:** Verify the given series is convergent or divergent by using different test and To inculcate knowledge on real numbers and their properties & proofs.
Level of attainment of CO1 to CO10: 100%		
M5301 (Th.)	Abstract Algebra (Group Theory and Ring Theory)	**Students will able to** **CO1:** Define rings , zero divisors of a ring , integral domain , field and prove theorems **CO2:** Group theory has a huge number of applications in the real world CO3: Define Group, Subgroup, Cosets, Homomorphism of groups, ect **CO4:** Explain Lagranges Theorem on finite groups **CO5:** To inculcate knowledge on algebraic equations and their relations with properties **CO6:** Define Homomorphism, Homorphic Image, Elementary Properties of Homomorphism **CO7:** Define Kernel of a Homomorphism and explain Fundamental theorem of Homomorhphism on Groups and Rings **CO8:** Define Integral Domains, Division Ring and Fields CO9: Define The characteristic of a ring ,The characteristic of an Integral Domain CO10: Define The characteristic of a Field. Sub Rings, Ideals and Boolean Rings, divisors of zero and cancellation laws Rings
Level of attainment of CO1 to CO10: 78%		
M5351 (Pr..)	Abstract Algebra (Group Theory and Ring Theory)	**Students be able to apply theoretical / analytical / statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during Practicals and draw meaningful solutions to day to day problems**

		CO1: Define rings , zero divisors of a ring , integral domain , field and prove theorems **CO2:** Group theory has a huge number of applications in the real world **CO3:** Define Group, Subgroup, Cosets, Homomorphism of groups, ect **CO4:** Explain Lagranges Theorem on finite groups **CO5:** To inculcate knowledge on algebraic equations and their relations with properties **CO6:** Define Homomorphism, Homorphic Image, Elementary Properties of Homomorphism **CO7:** Define Kernel of a Homomorphism and explain Fundamental theorem of Homomorhphism on Groups and Rings **CO8:** Define Integral Domains, Division Ring and Fields CO9: Define The characteristic of a ring ,The characteristic of an Integral Domain CO10: Define The characteristic of a Field. Sub Rings, Ideals and Boolean Rings, divisors of zero and cancellation laws Rings
Level of attainment of CO1 to CO10: 76%		
M5302 (Th.)	Numerical Analysis	**Students will able to** **CO1:** Define Basic concepts of operators Δ , E, ∇ **CO2:** Define The Calculus Of Finite Differences **CO3:** Find the difference of polynomial and define Interpolation with Equal Intervals **CO4:**Solve problems using Newton forward formula and Newton backward formula. **CO5:** Find the difference of polynomial and define Interpolation with un Equal Intervals **CO6:**Derive Gauss's formula and Stirling formula using Newton forward formula and Newton backward formula. **CO7:** Discuss about Numerical Differentiation **CO8:**Find maxima and minima for differencial difference equation Derive Trapezoidal rule, Simpson's 1/3 ,3/8 rules

		CO9: Derive Weddle's rule, The Euler's Maclaurin's Summation Formula. **CO10:** Derive Bisection Method, Method of Successive Approximation or Iteration Method, Method of False position or Regula False Method, Newton-Raphson method.
Level of attainment of CO1 to CO10: 75 %		
M5352 (Pr.)	Numerical Analysis	**Students be able to apply theoretical / analytical / statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during Practicals and draw meaningful solutions to day to day problems** **CO1:** Define Basic concepts of operators Δ , E, ∇ **CO2:** Define The Calculus Of Finite Differences **CO3:** Find the difference of polynomial and define Interpolation with Equal Intervals **CO4:**Solve problems using Newton forward formula and Newton backward formula. **CO5:** Find the difference of polynomial and define Interpolation with un Equal Intervals **CO6:**Derive Gauss's formula and Stirling formula using Newton forward formula and Newton backward formula. **CO7:** Discuss about Numerical Differentiation **CO8:**Find maxima and minima for differencial difference equation Derive Trapezoidal rule, Simpson's 1/3 ,3/8 rules **CO9:** Derive Weddle's rule, The Euler's Maclaurin's Summation Formula. **CO10:** Derive Bisection Method, Method of Successive Approximation or Iteration Method, Method of False position or Regula False Method, Newton-Raphson method.
Level of attainment of CO1 to CO10: 76%		
ME1 6301 (Th.)	Linear Algebra	**Students will able to** **CO1:** Define Vector Space, Quotient space Direct sum, linear span and linear independence, basis and inner product. **CO2:** Discuss the linear transformations, rank, nullity.

		CO3: Find the characteristic equation, eigen values and eigen vectors of a matrix. **CO4:** Prove Cayley- Hamilton theorem, Schwartz inequality, Gramschmidt orthogonalisation process. **CO5:** Solve the system of simultaneous linear equations and be able to apply matrices, systems of equations, regression, and eigenvectors to real world situations. **CO6:** Know vocabulary, notation, and operations for matrices and vectors. **CO7:** Be able to solve linear systems of equations using a variety of techniques and to select the best technique for a given system. **CO8:** Be able to define Linear Transformations and find the find the Domain, Range, Kernel, rank, and nullity of a linear transformation. **CO9:** Be able to apply vectors, inner products, and linear transformations to real world situations. **CO10:** Develop lesson plans that demonstrate their ability to explain concepts related to vectors and matrices.
Level of attainment of CO1 to CO10: 75%		
M E1 6351 (Pr.)	Linear Algebra	**Students be able to apply theoretical / analytical / statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during Practicals and draw meaningful solutions to day to day problems** **CO1:** Define Vector Space, Quotient space Direct sum, linear span and linear independence, basis and inner product. **CO2:** Discuss the linear transformations, rank, nullity. **CO3:** Find the characteristic equation, eigen values and eigen vectors of a matrix. **CO4:** Prove Cayley- Hamilton theorem, Schwartz inequality, Gramschmidt orthogonalisation process. **CO5:** Solve the system of simultaneous linear equations and be able to apply matrices, systems of equations, regression, and eigenvectors to real world situations. **CO6:** Know vocabulary, notation, and operations for matrices and vectors.

		CO7: Be able to solve linear systems of equations using a variety of techniques and to select the best technique for a given system. **CO8:** Be able to define Linear Transformations and find the find the Domain, Range, Kernel, rank, and nullity of a linear transformation. **CO9:** Be able to apply vectors, inner products, and linear transformations to real world situations. **CO10:** Develop lesson plans that demonstrate their ability to explain concepts related to vectors and matrices.
Level of attainment of CO1 to CO10: 84%		
M- A1-6301 (Th.)	Integral Transforms	**Students will able to** **CO1:** Solve Basic Integral Calculus problems. **CO2:** Explain properties of definite integrals. **CO3:** Prove reduction formulae and solve some problems by using this formulae. **CO4:** Evaluate double and triple integrals. **CO5:** Apply change variable method to find the value of double and triple integral. **CO6:** Explain properties of Beta functions. **CO7:** Derive relation between Beta and Gamma functions. **CO8:** Evaluate integrals by using Beta and Gamma functions. **CO9:** Find Fourier series expansions for given functions. **CO10:** Find Cosine and Sine series expansions for given functions.
Level of attainment of CO1 to CO10: 82%		
M-A1-6351 (Pr.)	Integral Transforms	**Students be able to apply theoretical / analytical / statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during Practicals and draw meaningful solutions to day to day problems** **CO1:** Solve Basic Integral Calculus problems. **CO2:** Explain properties of definite integrals. **CO3:** Prove reduction formulae and solve some problems by using this formulae.

		CO4: Evaluate double and triple integrals. **CO5:** Apply change variable method to find the value of double and triple integral. **CO6:** Explain properties of Beta functions. **CO7:** Derive relation between Beta and Gamma functions. **CO8:** Evaluate integrals by using Beta and Gamma functions. **CO9:** Find Fourier series expansions for given functions. **CO10:** Find Cosine and Sine series expansions for given functions.
Level of attainment of CO1 to CO10: 92%		
M-A2-6301 (Th.)	Advanced Numerical Analysis	**Students will able to** **CO1:** Find the solution of the first order and second order equation with constant coefficient **CO2:** Find the summation of series finite difference techniques **CO3:** Find the solution of ordinary differential equation of first by Euler, Taylor and Runge-Kutta methods **CO4:** Derive Least – Squares curve fitting procedures, fitting a straight line, nonlinear curve fitting, Curve fitting by a sum of exponentials. **CO5:** Derivatives using Newton's forward difference formula, Newton's backward difference formula, Derivatives using central difference formula, Stirling's interpolation formula, Newton's divided difference formula, Maximum and minimum values of a tabulated function. **CO6:** General Quadrature formula on errors, Trapozoidal rule, Simpson's 1/3 – rule, Simpson's 3/8 – rule, and Weddle's rules, Euler – Maclaurin Formula of summation and quadrature, The Euler transformation. **CO7:** Solution of linear systems – Direct methods, Matrix inversion method, Gaussian elimination methods, Gauss-Jordan Method CO8: Method of factorization, Solution of Tridiagonal Systems,.

		Iterative methods. Jacobi's method, Gauss-siedal method. **CO9:** Introduction, Solution by Taylor's Series, Picard's method of successive approximations **CO10:** Euler's method, Modified Euler's method, Runge – Kutta methods.
Level of attainment of CO1 to CO10: 91%		
M-A2-6351 (Pr.)	Advanced Numerical Analysis	**Students be able to apply theoretical / analytical / statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during Practicals and draw meaningful solutions to day to day problems** **CO1:** Find the solution of the first order and second order equation with constant coefficient **CO2:** Find the summation of series finite difference techniques **CO3:** Find the solution of ordinary differential equation of first by Euler, Taylor and Runge-Kutta methods **CO4:** Derive Least – Squares curve fitting procedures, fitting a straight line, nonlinear curve fitting, Curve fitting by a sum of exponentials. **CO5:** Derivatives using Newton's forward difference formula, Newton's backward difference formula, Derivatives using central difference formula, Stirling's interpolation formula, Newton's divided difference formula, Maximum and minimum values of a tabulated function. **CO6:** General Quadrature formula on errors, Trapozoidal rule, Simpson's 1/3 – rule, Simpson's 3/8 – rule, and Weddle's rules, Euler – Maclaurin Formula of summation and quadrature, The Euler transformation. **CO7:** Solution of linear systems – Direct methods, Matrix inversion method, Gaussian elimination methods, Gauss-Jordan Method CO8: Method of factorization, Solution of Tridiagonal Systems,. Iterative methods. Jacobi's method, Gauss-siedal method. **CO9:** Introduction, Solution by Taylor's Series, Picard's method of

		successive approximations **CO10:** Euler's method, Modified Euler's method, Runge – Kutta methods.
Level of attainment of CO1 to CO10: 96%		
M-A3-6301 (Th.)	Special Functions	**Students will able to** **CO1:** Derive Euler's Integrals – Beta and Gamma Functions, Elementary Properties of Gamma Functions, Transformation of Gamma functions **CO2:** Derive Another form of Beta functions, Relation between Beta and Gamma functions, Other transformations, Legendre Duplication Formula **CO3:** Define Legendre's equation, Definitions of $P_n(x)$ and $Q_n(x)$,To show that $P_n(x)$ is the coefficient of h^n in the expansion in ascending powers of $(1-2xh+h^2)^{-1\backslash 2}$ **CO4:** Derive Laplace definite integral for $P_n(x)$, Orthogonal properties of Legendre's Polynomials ,Recurrence formulae, Beltrami's results, Christoffer's summation Formula , Rodrigue's Formula **CO5:** Derive Laguerr's Differential Equation, Lagurre Polynomials, Generating Function, other forms for the Laguerre Polynomials(Rodrigues Formula). **CO6:** To find first few Laguerre Polynomials, Orthogonal Property of the Laguerre Polynomials. Recurrence formulae for Laguerre Polynomials. **CO7:** Derive Hermite Differential Equation , Hermite Polynomials, Generating Function, Other forms for the Hermite Polynomials **CO8:** To find first few Hermite Polynomials, Orthogonal Properties of Hermite Polynomials, Recurrence formulae for Hermite Polynomials **CO9:** Derive Bessel's equation , General Solution of Bessel's equation **CO10:** Define of $J_o(X)$,Recurrence Formulae for $J_n(X)$.
Level of attainment of CO1 to CO10: 83%		

M-A3-6351 (Pr.)	Special Functions	**Students be able to apply theoretical / analytical / statistical knowledge gained in various courses of B.Sc to solve numerical problems based on real life situations during Practicals and draw meaningful solutions to day to day problems** **CO1:** Derive Euler's Integrals – Beta and Gamma Functions, Elementary Properties of Gamma Functions, Transformation of Gamma functions **CO2:** Derive Another form of Beta functions, Relation between Beta and Gamma functions, Other transformations, Legendre Duplication Formula **CO3:** Define Legendre's equation, Definitions of $P_n(x)$ and $Q_n(x)$,To show that $P_n(x)$ is the coefficient of h^n in the expansion in ascending powers of $(1-2xh+h^2)^{-1\backslash 2}$ **CO4:** Derive Laplace definite integral for $P_n(x)$, Orthogonal properties of Legendre's Polynomials ,Recurrence formulae, Beltrami's results, Christoffer's summation Formula , Rodrigue's Formula **CO5:** Derive Laguerr's Differential Equation, Lagurre Polynomials, Generating Function, other forms for the Laguerre Polynomials(Rodrigues Formula). **CO6:** To find first few Laguerre Polynomials, Orthogonal Property of the Laguerre Polynomials. Recurrence formulae for Laguerre Polynomials. **CO7:** Derive Hermite Differential Equation , Hermite Polynomials, Generating Function, Other forms for the Hermite Polynomials **CO8:** To find first few Hermite Polynomials, Orthogonal Properties of Hermite Polynomials, Recurrence formulae for Hermite Polynomials **CO9:** Derive Bessel's equation , General Solution of Bessel's equation **CO10:** Define of $J_o(X)$,Recurrence Formulae for $J_n(X)$.
Level of attainment of CO1 to CO10: 77%		