BON SECOURS COLLEGE FOR WOMEN

Nationally Accredited with 'A' Grade by NAAC

UGC Recognized 2(f) and 12(B) Institution

VILAR BYPASS, THANJAVUR – 613 006

DEPARTMENT OF MATHEMATICS

PROGRAMME OUTCOMES:

PO1. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship Obtain quality education in the basic areas of Botany

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PROGRAMME SPECIFIC OUTCOMES:

PSO	PROGRAM SPECIFIC OUTCOMES	LEVEL OF ATTAINMENT
1	Ability to calculate and reason to design complex and critical financial models for Bank and Insurance Companies.	L2
2	Ability to understand both concrete and abstract problems.	L2
3	Ability to make critical observations	L3
4	Ability to accurately organize, analyze and interpret data.	L4
5	Develop the mathematical logic which is very useful for solving mathematical reasoning Problems.	L3
6	A research oriented learning that develops analytical and integrative problem-solving approaches.	L4
7	Keep on discovering new avenues in the chosen field and exploring areas that remain Conducive for research and development.	L4
8	Develop problem-solving skills and apply them independently to problems in pure and applied mathematics.	L3
9	Assimilate complex mathematical ideas and arguments and to improve your own learning and performance.	L6
10	Develop abstract mathematical thinking.	L3

COURSE OUTCOME FOR UNDER GRADUATE

COURSE CODE WITH TITLE	CO	OUTCOMES	LEVEL OF ATTAINMENT
16SCCMM1 Differential Calculus and trigonometry	**CO 1**	Understand the methods of successive differentiation and applications of Leibnitz's theorem	L 2
	CO 2	Recognize Radius of curvature and Centre of curvature	L 1
	CO 3	Interpret the expansions of trigonometric functions interms of multiples	L 2
	CO 4	Compare hyperbolic function and circular function	L 2
	CO 5	Estimate the logarithm of a complex number	L 5
	CO 6	Illustrate summation of Trigonometric series and Gregory's series	L 2
16SCCMM2 Integral Calculus	**CO 1**	Remember all integral models	L 1
	CO 2	Understand the Reduction formula	L 2
	CO 3	Recall polar coordinate and Cartesian coordinate system	L 1
	CO 4	Interpret area of plane curves and closed curves	L 2
	CO 5	Explain Triple integral and changing the order of integration for double integral	L 2
	CO 6	Recognize relation between beta gamma function	L 1
16SCCMM3 Differential Equations and Laplace transforms	**CO 1**	Illustrate the first orderdifferential equations	L 2
	CO 2	Demonstrate the particular integral of Second order differential equations with constant coefficient	L 2
	CO 3	Interpret solutions of partial differential equations of the standard form	L 2
	CO 4	Explain second order homogeneous equation with constant coefficients	L 2
	CO 5	Extend and list the Laplace Transform and Inverse Laplace Transform formulas	L 2
	CO 6	Show that Laplace transform is used to solve linear differential equations with constant coefficient	L 2
16SCCMM4 Analytical Geometry 3D	**CO 1**	To identify 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	L 1
	CO 2	Explain the Shortest distance between two skew lines , Define coplanar lines and illustrate (L2)	L 2
	CO 3	Identify centre and radius of Sphere and circles and also find family of spheres Passing through a circle , tangent planes and normal lines to a sphere	L 1

	CO 4	Label equation of Cone , enveloping cone ,cylinder ,right circular cylinder , enveloping cylinder and prove their results and Find equation of tangent plane, reciprocal cone of given cone	L 1
	CO 5	Identify different conicoids and Understand relationship between different coordinate systems and plot the curve in Spherical, cylindrical polar coordinates	L 2
	CO 6	Illustrate the use of exponential and logarithmic functions and show applications in the technical field	L 2
16SCCMM5 Sequence and series	**CO 1**	Illustrate different types of sequence	L 2
	CO 2	Classify the given sequence in convergent and divergent by using behaviour of Monotonic sequence	L 2
	CO 3	Illustrate Cauchy's first limit theorem, Cesaro's theorem, Cauchy's Second limit theorem	L 2
	CO 4	Explain subsequences and upper and lower limits of a sequence	L 2
	CO 5	Solve examples for convergence, divergence and oscillating series	L 3
	CO 6	Choose the given series is convergent or divergent by using different test	L 5
16SCCMM6 Classical Algebra and Theory of Numbers	**CO 1**	Explain the relation between roots and coefficients and symmetric functions	L 2
	CO 2	Interpret sum of the power of the roots and increase or decrease the roots by a given quantity	L 2
	CO 3	Illustrate quotient and remainder and to form of an equation whose roots are any power	L 2
	CO 4	Understand the concepts of inequalities	L 2
	CO 5	Recall the prime and composite numbers	L 1
	CO 6	Utilize Fermat's, Wilson's and Lagrange's theorem	L 3
16SCCMM7 Vector Calculus and Fourier series	**CO 1**	Explain vector differentiation and to illustrate the computation of limits and derivatives of functions	L 2
	CO 2	Demonstrate the concepts of gradient, directional derivative and Laplacian operator	L 2
	CO 3	Solve the problems on fields involving line, surface and volume integral	L 3
	CO 4	Demonstrate the use of Green's, Stokes' and Gauss Divergence theorems and verify it	L 2
	CO 5	Illustrate the concept of Fourier series and to apply the odd and even functions of Fourier series	L 2
	CO 6	Explain the concept of Half range Fourier series, cosine and sine series and change of interval	L 2
16SCCMM8 Linear Algebra	**CO 1**	Understand the concepts of vector spaces, subspaces and span of a set	L 2
	CO 2	Discuss the Linear independence, basis, dimension and their properties	L 2
	CO 3	Relate matrices and linear transformations and	L 2

		properties of inner product spaces	
	CO 4	Apply Cauchy-Schwarz inequality for deriving metric on inner product spaces and obtain orthonormal basis using Gram-Schmidt orthogonalisation	L 3
	CO 5	Classify the types of matrices and rank of a matrix	L 2
	CO 6	Apply Cayley Hamilton theorem and characteristic equation	L 3
	CO 7	Interpret eigen values and eigen vectors of linear transformations	L 2
16SCCMM9 Numerical Methods with Matlab Programming	**CO 1**	Select recognizable with fundamental operations in Matlab	L 3
	CO 2	Interpret and visualize simple mathematical functions and operations there on using plots / display	L 2
	CO 3	Create and control simple plot and user-interface graphics objects in MATLAB	L 6
	CO 4	Apply statistical data analysis, data interpolation by Matlab, solve differential equation with Matlab	L 3
	CO 5	Estimate the curve fitting for various polynomials and know how to find the roots of transcendental equations	L 5
	CO 6	Justify how to interpolate the given set of values and to learn numerical solution of integral equations	L 2
16SCCMM10 Real Analysis	**CO 1**	Classify and understand the fundamental concept of Field axiom, Absolute value, Supremum and infimum and order completeness property	L 2
	CO 2	Analyze the functions using limits of a function, derivatives, Uniform continuity of a function	L 4
	CO 3	Discover the derivability f ‘, and inverse of a function using daurboux theorem	L 4
	CO 4	Recall the concepts of differentiability in Rolle’s, Mean value and Taylor’s theorems and to know their advanced properties	L 1
	CO 5	Solve the higher order problems using Power series expansions	L 3
	CO 6	Classify the basic attributes of the Riemann integral, derivability and continuity of a function, the properties of integrability functions by means of their sums, difference, product quotients and modulus	L 2
16SCCMM11 Statics	**CO 1**	Examine the static objects, concepts of force, moment, and mechanical equilibrium	L 4
	CO 2	Analyse forces in two and three dimensions using vectors	L 4
	CO 3	Examine and solve the problems in moments due to a couple	L 4
	CO 4	Build a free body diagram including all external and reaction forces and moments	L 3

	CO 5	Examine and solve problems related to general cases of static and kinetic friction	L 4
	CO 6	Able to develop the catenary curve and to find sag and span	L 3
16SMBEMM1:1 Operations Research	**CO 1**	Develop linear programming (LP) models for shortest path, maximum flow, minimal spanning tree, critical path, minimum cost flow, and transshipment problems	L 3
	CO 2	Analyze simplex method	L 4
	CO 3	Distinguish two phase method	L 4
	CO 4	Apply MODI method to solve transportation problem	L 3
	CO 5	Classify Queuing models	L 2
	CO 6	Solve CPM and PERT problem	L 3
16SCCMM12 Abstract Algebra	**CO 1**	Apply the fundamental concepts of groups and permutation groups	L 3
	CO 2	Develop subgroups, cyclic groups cosets and Lagrange's theorem	L 3
	CO 3	Distinguish homomorphism and isomorphism	L 4
	CO 4	Classify Rings, Characteristic of ring, subrings and quotient rings	L 2
	CO 5	Examine the concepts of ideals, integral domains, and fields	L 4
	CO 6	Categorize Unique factorization domain and Euclidean domain	L 4
16SCCMM13 Complex Analysis	**CO 1**	Provide the basic knowledge of the concepts of limit, continuity and differentiability of a complex valued function	L 3
	CO 2	Solve the analytic functions and harmonic functions	L 3
	CO 3	Evaluate complex integration and to solve the complex functions using Cauchy's integral formula	L 5
	CO 4	Compare the series expansions such as Taylor's series and Laurant's series	L 2
	CO 5	Classify and solve singularities and to express Residue theorem	L 2
	CO 6	Evaluate definite integral using Cauchy's residues theorem	L 5
16SCCMM14 Dynamics	**CO 1**	Compare Relative velocity and Angular velocity	L 2
	CO 2	Distinguish the path of a projectile – Characteristics – horizontal projection	L 4
	CO 3	Apply the principle of independence of motion to solve projectile motion problem	L 3
	CO 4	Analyze the collision of elastic bodies	L 4
	CO 5	Classify simple harmonic function	L 2
	CO 6	Solve the pedal equations of the central orbit- two fold problems in central orbit	L 3
16SMBEMM2:1 Graph Theory	**CO 1**	Understand and apply the fundamental concepts in graph theory	L 2
	CO 2	Identify induced subgraphs, cliques, matchings, covers in graphs	L 1

	CO 3	Integrate core theoretical knowledge of graph theory to solve problems	L 2
	CO 4	Understand various types of trees and methods for traversing trees	L 2
	CO 5	Solve problems involving vertex and edge connectivity, planarity and crossing numbers	L 3
	CO 6	Analyze new networks using the main concepts of graph theory	L 4
16SMBEMM3:1 Astronomy	**CO 1**	Apply and explain the observed daily and long-term motion of objects (sun, moon, planets, stars)	L 3
	CO 2	Provide the balance between radiation and gravity in various types of stars, and relate this to the aging process	L 3
	CO 3	Conclude uses and natural occurrences of refraction	L 4
	CO 4	Discover how the universal law of gravitation accounts for Kepler's laws	L 4
	CO 5	Distinguish how the Moon rotates and revolves around Earth	L 4
	CO 6	Compare how gravity is related to the formation, interaction and evolution of the solar system	L 2

COURSE OUTCOME FOR POST GRADUATE

COURSE CODE WITH TITLE	CO	OUTCOMES	LEVEL OF ATTAINMENT
P16MA11 Algebra	**CO 1**	Analyse Sylow's theorem to solve different problems	L 4
	CO 2	Understand the concepts of homomorphism between groups	L 2
	CO 3	Examine rings, ideals, quotient rings and Euclidean rings	L 4
	CO 4	Demonstrate the polynomial rings over fields	L 2
	CO 5	Interpret extension fields and its applications	L 2
	CO 6	Analyse and interpret the elements of Galois theory	L 4
P16MA12 Real Analysis	**CO 1**	Use Convergence Sequence, and Absolute Convergence in Physical Science	L 3
	CO 2	Categorize logical development of continuity and discontinuity	L 4
	CO 3	Develop students in learning fundamental ideas and theorem about Riemann- Stieltje's integral	L 3
	CO 4	Classify the integration of vector valued function	L 4
	CO 5	Organize the Sequence and Series of functions	L 4
	CO 6	Analyze the concepts of functions of several variables	L 3

P16MA13 Ordinary Differential Equation	**CO 1**	Estimate the complete solution of a differential equation with constant coefficients by variation of parameters	L 5
	CO 2	Demonstrate about the Legendre polynomials and Bessel functions	L 2
	CO 3	Inspect and solve the first order differential equations utilizing the standard techniques for separable, exact, linear, homogeneous, or Bernoulli cases and Picard's theorem	L 4
	CO 4	Able to estimate the eigen values, eigen functions and the vibrating string	L 5
	CO 5	Able to elaborate and solve nonlinear equations	L 6
	CO 6	Able to inspect and analyse the existence and uniqueness of the solutions	L 4
P16MA14 Graph Theory	**CO 1**	Recognize the mathematical definitions in graph theory	L 1
	CO 2	Interpret the basic concept, connectivity, trees ,simple properties ,independent set and matching of graph theory	L 2
	CO 3	Utilize the concept of Eulerian graphs, Hamiltonian graphs	L 3
	CO 4	Apply the concept of graph colouring –critical graphs triangle –free graphs-edge colouring of graphs	L 3
	CO 5	Estimate the Chromatic number of given graph	L 5
	CO 6	Compare the planar and non-planar graphs	L 2
P16MA15 Integral Equations, Calculus of Variations and Transforms	**CO 1**	Analyze the concept of Natural boundary and transition conditions and to solve Sturm-Liouville problems	L 4
	CO 2	Estimate maxima and minima, critical points and inflection points of function	L 5
	CO 3	Develop the foundation of Finite Fourier sine and cosine transforms - Fourier integral theorem and Parseval's identity	L 3
	CO 4	Examine the advance applications of derivatives using Hankel Transform	L 4
	CO 5	Classify the methods of Linear Integral Equations Definition, Regularity conditions special kind of kernels	L 4
	CO 6	Discuss the Classical Fredholm Theory and the method of solution of Fredholm theories	L 4
P16MA21 Complex Analysis	**CO 1**	Recall the concept of connectedness ,compactness, topological spaces	L 1
	CO 2	Illustrate the line integral ,Cauchy's integral formula	L 4
	CO 3	Solve the zeros and poles of the complex function	L 3
	CO 4	Examine the Residue of the complex function	L 4
	CO 5	Distinguish the simple connected region and	L 4

		multiply connected region	
	CO 6	Estimate the harmonic function, Poisson's formula	L 5
P16MA22 Linear Algebra	**CO 1**	Analyse the concepts of systems of linear equations and row-reduced echelon matrices and its importances in real world problems	L 4
	CO 2	Understand the concepts of bases and dimensions of vector spaces	L 2
	CO 3	Demonstrate the application of linear transformation by matrices	L 2
	CO 4	Examine the algebra of polynomials and polynomial ideals	L 4
	CO 5	Estimate determinants and characteristic values	L 5
	CO 6	Interpret invariant spaces, simultaneous triangulation and simultaneous Diagonalization and invariant direct sums	L 2
P16MA23 Partial Differential Equation	**CO 1**	Illustrate the first order partial differential equations	L 4
	CO 2	Analyze the origin of first order partial differential equations and solving them using Charpit's method	L 4
	CO 3	Apply solutions to second order partial differential equations in physics	L 3
	CO 4	Elaborate characteristics of equations in three variables and separation of variables	L 6
	CO 5	Estimate boundary value problems	L 5
	CO 6	Distinguish the elementary equation of laplace equations	L 4
P16MAE1C Fuzzy Sets and its applications	**CO 1**	Distinguish the fuzzy sets from crisp sets and their properties	L 4
	CO 2	Classify the fuzzy operations	L 4
	CO 3	Examine the fuzzy numbers and its arithmetic operations in real world problems	L 4
	CO 4	Examine different types of fuzzy relations	L 4
	CO 5	Demonstrate the fuzzy decision making methods under uncertainty	L 2
	CO 6	Interpret the uncertainty environment through fuzzy linear programming	L 2
P16MAE2B Tensor analysis and special theory of relativity	**CO 1**	Analyse the concepts of Tensors	L 4
	CO 2	Demonstrate Christoffel symbols and its related problems	L 2
	CO 3	Estimate Tensor differentiation and Christoffel curvature tensor	L 5
	CO 4	Elaborate the use of Gallielian transformation, Principle of relativity and relativistic Kinematics	L 6
	CO 5	Interpret the principle of equivalence and accelerated systems	L 2
	CO 6	Able to interpret the extended application of Einstein's concepts	L 2

P16MA31 Classical Dynamics	**CO 1**	Recall the foundations of mechanical system using energy and momentum	L 1
	CO 2	Apply the Derivation and examples in association with Lagrange's equation	L 3
	CO 3	Demonstrate the special applications of Lagrange's equations in terms of Rayleigh's dissipation function, impulsive motion, Gyroscopic systems	L 2
	CO 4	Illustrate the definitions of velocity dependent potentials	L 2
	CO 5	Discover the Hamiltonian's principal and other variation principles	L 4
	CO 6	Solve the problems using the Jacobi theory and Hamilton Jacobi equations	L 3
P16MA32 Measure and integration	**CO 1**	Analyze the concept of measure on real line	L 4
	CO 2	Assess the concept of integration in more general defined on the real line, extending the notion of Riemann integration	L 5
	CO 3	Distinguish the concept of length, area, volume etc to measure spaces leading to lebesgue measure on Euclidean spaces	L 4
	CO 4	Interpret convergence in measure	L 2
	CO 5	Estimate measurability in product space that lead to development of measure theory	L 5
	CO 6	It's estimate a treatment of Fibini's theorem and allows quick access to the convergence of theorem	L 5
P16MA33 Topology	**CO 1**	Interpret the basic concepts of various topological spaces	L 2
	CO 2	Build knowledge and understanding the concepts of open and closed sets	L 3
	CO 3	Formulate continuous functions and homeomorphisms to understand the structure of topological spaces	L 6
	CO 4	Elaborate connected and local connectedness of the real line	L 6
	CO 5	Interpret the compact spaces of the real line through examples	L 2
	CO 6	Formulate various countability and separation axioms in real world problems	L 6
P16MAE3B Discrete Mathematics	**CO 1**	Indentify the relation , ordered relation ,function and recursion	L 1
	CO 2	Recall the concept of Connectives and recognize the normal forms, theory of inference for the statement calculus and predicate calculus	L 1

	CO 3	Use the concept of lattice in various fields	L 3
	CO 4	Analyze the concept of Boolean Algebra and graph codes	L 4
	CO 5	Criticize the concept of switching Algebra	L 4
	CO 6	Formulate Grammar language , Phrase structure grammar	L 5
P16MAE4B Advanced Operations Research	**CO 1**	Interpret integer programming model with Branch-and Bound technique and with Gomory cutting plane Technique	L 2
	CO 2	Elaborate fundamentals of dynamic programming and stochastic dynamic Programming approaches	L 6
	CO 3	Choose, builds and develop solutions to the model of Game theory	L 3
	CO 4	Justify the best strategy according to decision criteria under risk and uncertainty	L 5
	CO 5	Understand the usage of game theory and Simulation for Solving Business problems	L 2
	CO 6	Estimate and apply different algorithms for solving goal or integer programming,non linear programming problems	L 5
P16MA41 Functional Analysis	**CO 1**	Analyze ideas from analysis in order to handle algebraic systems and Banach spaces	L 4
	CO 2	Choose Hilbert spaces and operator theory leading to spectral theory of operations and Hilbert spaces	L 3
	CO 3	Categorize the finite dimensional spectral theory	L 4
	CO 4	Analyze the importance of topological divisors of zero and semi simplicity	L 4
	CO 5	Justify the formula for the spectral radius	L 5
	CO 6	Classifi the structure of commutative Banach algebras	L 4
P16MA42 Differential Geometry	**CO 1**	Recall the notions of surfaces and their properties	L 1
	CO 2	Explain the intrinsic equations, normal and binomial, curvature and torsion and solve the problems by using the methods	L 2
	CO 3	Illustrate the curves on a surface, Helicoids, families of curves, Isometric correspondence	L 2
	CO 4	Classify the problems under canonical geodesic equations, normal property of geodesic and surface of constant curvature	L 4
	CO 5	Apply the concept of lines of curvature, minimal surfaces and ruled surfaces by solving the problems	L 3
	CO 6	Analyze the properties of Hilbert's lemma, compact surface of constant curvature	L 4

P16MA43 Advanced Numerical Analysis	**CO 1**	Recall the Secant, Regular false method and Newton Raphson Method	L 1
	CO 2	Illustrate Jacobi iteration method, Gauss Seidel method, iteration method	L 2
	CO 3	Solve the Algebraic equation using interpolation and approximation bivariate interpolation	L 3
	CO 4	Compare the Runge kutta method 1 and Runge kutta method 2	L 2
	CO 5	Elaborate the numerical Interpolationn, Extrapolation method	L 6
	CO 6	Elaborate the method of local truncation error or discretization error	L 6
P16MAE5C Algebriac Number Theory	**CO 1**	Interpret the results in divisibility and greatest common divisors and solve the congruences and using Chinese's theorem to solve a system of two or more simultaneous linear congruences	L 2
	CO 2	Elaborate the importances of public key cryptography and power moduli and power residues	L 4
	CO 3	Build the knowledge in number theory from an algebraic viewpoint	L 3
	CO 4	Formulate binary quadratic forms and their types	L 6
	CO 5	Estimate the Mobius inversion formula and develop combinatorial number theory	L 5
	CO 6	Interpret the solution of linear Diophantine equation $ax + by = c$	L 2