CENTRE FOR DISTANCE AND ONLINE EDUCATION

BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI – 620 024.

Allied Mathematics for

B.Sc. Physics / Chemistry / Industrial Electronics / Geology – Students

(Applicable to the candidates admitted form the academic year 2026-2027 onwards)

Year: I		**Semester:** I
	ALLIED COURSE I **CALCULUS AND FOURIER SERIES**	

Objectives:

1. To learn the basic Mathematics for their concepts.
2. To train the students in the basic Integrations.

UNITI

Successive Differentiation – nth derivative of standard functions (Derivation not needed) simple problems only-Leibnitz Theorem (proof not needed) and its applications –Total differential coefficients (proof not needed) - Jacobians of two & three variables –Simple problems in all these.

UNITII

Evaluation of integrals of types:

1) $\int \frac{dx}{a+b\cos x}$ 2) $\int \frac{dx}{a+b\sin x}$

Integration by trigonometric substitution and by parts of the integrals

1) $\int \sqrt{a^2-x^2}\,dx$ 2) $\int \sqrt{a^2+x^2}\,dx$ 3) $\int \sqrt{x^2-a^2}\,dx$

UNITIII

General properties of definite integrals – Reduction formula (When n is a positive integer) for

1) $\int_a^b e^{ax}x^n dx$ 2) $\int_a^b \sin^n x\,dx$ 3) $\int_a^b \cos^n x\,dx$ 4) $\int_0^x e^{ax}x^n dx$ 5) $\int_0^{\frac{\pi}{2}} \sin^n x\,dx$

UNITIV

Evaluation of Double and Triple integrals in simple cases –Changing the order and evaluation of double integral. (Cartesian only)

UNITV

Definition of Fourier Series – Finding Fourier Coefficients for a given periodic function with period 2π - Use of Odd & Even functions in evaluating Fourier Coefficients - Half range sine & cosine series.

UNIT – VI (Advanced topics only for discussion)

Current Contours: Linear approximations of vector valued functions

TEXTBOOK(S)

1. T.K. Manickavasagam Pillai & others, Calculus, Volume I, S.V Publications, Reprint 2016(Unit I).
2. T.K. Manickavasagam Pillai & others, Calculus, Volume II, S.V Publications, Reprint 2016(Units II,III& IV).
3. S. Arumugam, Isaac and Somasundaram, Trigonometry & Fourier Series, New Gamma Publishers, Hosur, 1999(Unit V)

REFERENCE(S)

1. M.L. Khanna, Differential Calculus, Jaiprakashnath and Co., Meerut-2004.

Course Outcomes : After completing this course, the students will be able to

1. Explain the relationship between the derivative of a function as a function and the notion of the derivative as the slope of the tangent line to a function at a point.
2. Derive reduction formula and thereby evaluate some standard integrals.
3. Identify odd and even functions. Use that to determine Fourier series expansion of the given functions.
4. Apply change of variable method to evaluate double integral.

Year : I		**Semester :** II
	ALLIED COURSE II **ALGEBRA, ANALYTICAL GEOMETRY (3D) AND TRIGONOMETRY**	

Objectives :

1. To learn the basic concepts of Algebra
2. To learn the basic needs Trigonometry

UNITI

Binomial, Exponential and Logarithmic series (Formulae only) – summation & approximation related problems only.

UNITII

Non-Singular, Symmetric, Skew symmetric, Orthogonal, Hermitian, Skew Hermitian and Unitary matrices – Characteristic equation, Eigen values, Eigen vectors – Cayley-Hamilton's Theorem (proof not needed) –Simple applications only.

UNITIII

Finding the Shortest distance between two skew lines and the equation of the plane containing them– Condition for Coplanarity – Equation of a Sphere – Tangent plane – Plane section of a sphere.- Finding the center & radius of the circle of intersection – Sphere through the circle of intersection (only problems in all the above)

UNITIV

Expansion of $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ (n being a positive integer) - Expansion of $\sin^n \theta$, $\cos^n \theta$, $\sin^n \theta \cos^m \theta$ in a series of sines & cosines of multiples of θ (θ - given inradians) - Expansion of $\sin \theta$, $\cos \theta$, $\tan \theta$ in terms of powers of θ(onlyproblems in all the above).

UNITV

Euler's formula for $e^{i\theta}$ - Definition of Hyperbolic functions –Formulae involving Hyperbolic functions -Relation between Hyperbolic & circular functions – Expansion of $\sinh x$, $\cosh x$, $\tanh x$ in powers of x .

UNIT – VI (Advanced topics only for discussion)

Current Contours: AnIntroduction to SAGEMATH

TEXTBOOK(S)

1. T.K. Manickavasagam Pillai & others, Algebra, Volume I, S.V Publications , Reprint 2016(Unit I)
2. T.K.ManicavachagamPillai& others, Algebra, Volume II, S.V Publications , Reprint 2016(Unit II)
3. T.K.Manickavasagom Pillai, Analytical Geometry (3D) and Vector Calculus, New Gamma Publishing House, 1991(Unit III).
4. S. Arumugam, Isaac and Somasundaram, Trigonometry & Fourier Series, New Gamma Publishers, Hosur, 1999(Units IV & V)

REFERENCE(S)

1. M.L. Khanna, Differential Calculus, Jaiprakashnath and Co., Meerut-2004.

Course Outcomes : After completing this course, the students will be able to

1. Applying the skills to solve problems in operative algebra.
2. Gain knowledge about the regular geometrical figures and their properties.
3. To Understand the definitions of the inverse trigonometric functions and to Compute the domain and range of the hyperbolic and inverse trigonometric functions and to find exact values of composite functions with inverse trigonometric functions

Year : I		**Semester :** II
	ALLIED COURSE III **ODE,PDE,LAPLACETRANSFORMSANDVECTOR ANALYSIS**	

Objectives:

1. The Students will be able to apply the concepts and methods described in the syllabus they can solve problems using the ordinary and partial differential equation.
2. They will know a number of applications The text and class discussion will introduce the concepts, methods, applications, and logical arguments
3. Learn the application of Laplace transform in engineering analysis.
4. Learn the required conditions for transforming variable or variables in functions by the Laplace transform.
5. Learn the use of available Laplace transform tables for transformation of functions and the inverse transformation.
6. Vector analysis is a mathematical shorthand and the vector form helps to provide the clear understanding of the physical laws. This makes the calculus of the vector functions the natural instrument for the physicist and engineers in solid mechanics, electromagnetism.

UNITI

Linear equations with constant coefficients—Finding Particular integrals in the cases of e^x, sin (kx) , cos (kx) (where kis aconstant), x* where kis apositiveinteger, and e "' *f(x)* where f(x) is any function of x-(only problem sin al the above —No proof needed for any formula).

UNITII

Formation of Partial differential equations by eliminating constants and by elimination of arbitrary functions—definition of general , particular & complete solutions —Singular integral (geometrical meaning not required)—Solutions of first order equations in thes tandard forms-$f(p,q)=0$,$f(x,p,q)=0$, $f(y,p,q)=0$,$f(z,p,q)=0$, $f_1(x,p)=f_2(y,q)$,$z=xp+yq+f(p,q)$–(Geometrical Meaning is not needed)-(only problem sinall the above— No proof needed for any formula).

UNIT III

Laplace Transform – Definition – Lee^{at}), L(cos at), L(sin at), L(t^n), where n is a positive integer. Basic theorems in Laplace Transforms (formula only) – L(e^{at} cos bt), L(e^{at} sin bt), L[e^{-at} f(t)], L[f(at)], L[f′(t)], L[f″(t)].

UNIT IV

Inverse Laplace Transforms related to the above standard forms.

UNIT V

Gradient of a vector – Directional derivative – Unit normal vector – Tangent plane – Divergence – Curl – Solenoidal and irrotational vectors – Double operators – Properties connecting grad, div. and curl of a vector.

UNIT – VI (Advanced topics only for discussion)

Current Contours: Introduction to Linear Systems of Differential Equations

TEXT BOOK(S)

1. S.Narayanan& T.K. Manicavachagam PillayDifferential Equation and its Applications, S. Viswanathan Publishers, 2015(Units I,II,III & IV).
2. M.L. Khanna, Differential Calculus, Daiprakashnath and Co., Meerut-2004(Unit V).

Course Outcome : After completing this course, the students will be able to

1. Solve differential equations using appropriate methods and to present mathematical solutions in a concise and informative manner.
2. Develop a logical understanding of the subject with mathematical skills so that students are able to apply mathematical methods & principles in solving problems in engineering fields.
3. Calculate Laplace transforms and inverses.
4. Apply Laplace transforms to solution of differential and integral equations
5. Explain the physical significance of vector calculus,parameterise curves and calculate line integrals,
6. Use vector operators, calculate double and triple integrals and surface integrals, apply the Green's, Stokes and Divergence theorems and calculate complex integrals.

CENTRE FOR DISTANCE AND ONLINE EDUCATION

BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI – 620 024.

Allied Mathematics for

B.Sc. Computer Science, B.Sc. Information Technology, BCA & B.Sc. Software Development Programmes

(Applicable to the candidates admitted form the academic year 2026-2027 onwards)

Year : I		**Semester :** I
	ALLIED COURSE I **ALGEBRA AND CALCULUS**	
Code :		**Credit :**

Objectives :

1. To train the students to solve the problems in theory of equations
2. To provideknowledge about the matrix, differentiation and various methods for evaluation of integrals.

UNITI

Theory of Equations: Relation between roots & coefficients – Transformations of Equations – Diminishing, Increasing& multiplying the roots by a constant –simple problems.

UNITII

Matrices : Singular matrices – Inverse of a non-singular matrix using adjoint method - Rank of a Matrix – Consistency - Characteristic equation, Eigen values, Eigen vectors – Cayley Hamilton's Theorem (proof not needed) –Simple applications only

UNITIII

Differentiation: Maxima & Minima – Concavity , Convexity – Points of inflexion- Partial differentiation – Euler's Theorem - Total differential coefficients (proof not needed) –Simple problems only.

UNITIV

Evaluation using Integration by parts – Properties of definite integrals – Fourier Series in the range $(0, 2\pi)$ – Odd & Even Functions – Fourier Half range Sine & Cosine Series

UNITV

Differential Equations: Linear equations – Second order of types $(aD^2 + bD + c)y = F(x)$ where a,b,c are constants and $F(x)$ is one of the following types$(i)e^{Kx}(ii)\sin(kx)$ or $\cos(kx)\,(iii)x^n, n$ beinganinteger$(iv)e^{Kx}f(x)$

UNIT – VI (Advanced topics only for discussion)

Current Contours: Derivatives of Implicit and parametric Functions

TEXTBOOK(S)

1. T.K. Manickavasagam Pillai & others, Algebra, Volume I& II, S.V Publications , 1985 Revised Edition(Units I, II)
2. S. Narayanan, T.K. Manicavachagam Pillai, Calculus, Vol. II, S. Viswanathan Pvt Limited, 2003. (Units III, IV and V)

REFERENCE(S)

1. M.L. Khanna, Differential Calculus, Jaiprakashnath and Co., Meerut-2004.

Course Outcomes : After completing this course, the students will be able to

1. Train the students to solve the problems in theory of equations.
2. Apply Cayley Hamilton theorem for finding the inverse of square matrices.
3. Get exposed the basic concepts of differentiation and integration.
4. Acquire the knowledge about differential equations.

Year : I		**Semester :** II
	ALLIED COURSE II **NUMERICAL ANALYSIS AND PROBABILITY**	
Code :		**Credit :**

Objectives :

1. To learn knowledge about an algebraic and transcendental equations.
2. To make the students gain wide knowledge in probability which plays a main role in solving real life problems.

UNITI

Algebraic & Transcendental equations: Bisection Method, Newton Raphson Method, Iteration method - Finite differences – Forward, Backward differences – Newton's forward & backward difference interpolation formulae – Lagrange'sinterpolating polynomial.

UNITII

Numerical differentiation - Numerical Integration using Trapezoidal rule and Simpson's first & second rules (proof not needed) - Solutions to Linear Systems – Gaussian Elimination Method – Jacobi & Gauss Siedal iterative methods – Theory and problems.

UNITIII

Numerical solution of ODE: Solution by Taylor Series Method , Euler's Method, Runge - Kutta 2nd order method.

UNITIV

Arithmetic Mean – Geometric Mean – Harmonic Mean - Median, Mode , Standard Deviation - Quartile Deviation – Percentiles - Expectation – Variance and covariance.

UNITV

Correlation and Regression –Properties of Simple Correlation and regression coefficients – Simple Numerical Problems only.

UNIT – VI (Advanced topics only for discussion)

Current Contours: An introduction to MATLAB

TEXTBOOK(S)

1. S.S.Sastry, Numerical Analysis (Unit 1 , 2 , 3)
2. Gupta.S.C & Kapoor, V.K, Fundamentals of Mathematical Statistics, Sultan Chand & sons, New Delhi -1994. (Units 4 & 5)

REFERENCE(S)

3. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Private Limited, 1999.
4. C.E. Froberg, Introduction to Numerical Analysis, II Edn., Addison Wesley, 1979.

Course Outcomes : After completing this course, the students will be able to

1. Solve algebraic and transcendental equations.
2. Appreciate the importance of probability of random variables and understand the correlation and regression coefficients.

Year : I		**Semester :** II
	ALLIED COURSE III **OPERATIONS RESEARCH**	
Code :		**Credit :**

Objectives :

1. To learn the basic concepts about Linear Programming Problem, Transportation Problem Assignment Problem, Sequencing Problem and Network.
2. To make students solve real life problems in Business and Management.

UNIT I

Operations Research : Introduction - Basics of OR – OR & decision making – Role of Computers in OR - Linear programming formulations & graphical solution of two variables.

UNITII

Simplex Method: Simplex Method for <, =, > constraints – Charne's method of penalties– Two phase Simplex method.

UNITIII

Transportation problem - LP formulation of the TP - Solution of a TP - Finding an initial basic feasible solution (NWCM - LCM -VAM) – Degeneracy in TP - Transportation Algorithm (MODI Method) .

UNITIV

Assignment problem - Solution methods of assignment problem – special cases in assignment problem.

UNITV

Networks: Network – Fulkerson's rule - measure of activity – PERT computation– CPM computation.

UNIT – VI (Advanced topics only for discussion)

Current Contours: Integer and Dynamic programming.

TEXTBOOK(S)

1. Manmohan & Gupta , Operations Research, Sultan Chand Publishers, New Delhi

REFERENCE(S)

1. Prem Kumar Gupta and D.S. Hira, Operations Research : An Introduction,
2. S. Chand and Co., Ltd. New Delhi,
3. Hamdy A.Taha, Operations Research (7th Edn.), McMillan Publishing Company, New Delhi, 1982.

Course Outcomes: After completing this course, the students will be able to

1. Acquire the basic concepts of LPP.
2. Apply various methods for finding a solution of an LPP.
3. Use the basic concepts of TP, AP and NetworkProblemstodevelop the problem solving skills.

CENTRE FOR DISTANCE AND ONLINE EDUCATION

BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI – 620 024.

Allied Mathematics forB.Sc. Statistics
(Applicable to the candidates admitted form the academic year 2026-2027 onwards)

Year: I		**Semester:** I
	ALLIED COURSE I **CALCULUS, LAPLACE TRANSFORM AND FOURIER SERIES**	
Code :		**Credit:**

Objectives:

1. To train the students in basic calculus
2. To learn the basic ideas of Fourier Series

UNITI

Maxima & Minima – Concavity , Convexity – Points of inflexion – Partialdifferentiation – Euler's Theorem - Total differential coefficients (proof notneeded) –Simple problems only.

UNITII

Evaluation of integrals of types:

1) $\int \frac{dx}{a+b\cos x}$ 2) $\int \frac{dx}{a+b\sin x}$

Evaluation using Integration by parts. Integration by trigonometric substitution and by parts of the integrals

1) $\int \sqrt{a^2-x^2}\,dx$ 2) $\int \sqrt{a^2+x^2}\,dx$ 3) $\int \sqrt{x^2-a^2}\,dx$

UNITIII

General properties of definite integrals –
Evaluation of Double and Triple integrals in simplecases- Changing the order and evaluation of the double integration – Beta,Gamma functions.

UNITIV

Laplace Transforms – Inverse Laplace Transforms.

UNITV

Definition of Fourier Series – Fourier Coefficients for a given periodic function with period 2π - Use of Odd & Even functions in evaluating Fourier Coefficients– Half range sine & cosine series.

UNIT – VI (Advanced topics only for discussion)

Current Contours: Convolution Integrals

TEXTBOOK(S)

1. S. Narayanan, T.K. Manichavasagam Pillai, Calculus, Vol. II, S. Viswanathan Pvt Limited, 2003
2. S. Narayanan, T.K. Manicavachagam Pillai, Calculus, Vol. III, S. Viswanathan Pvt Limited, and Vijay Nicole Imprints Pvt Ltd, 2004.

Course Outcomes : After completing this course, the students will be able to

1. Explain the relationship between the derivative of a function as a function and the notion of the derivative as the slope of the tangent line to a function at a point.
2. Derive reduction formula and thereby evaluate some standard integrals.
3. Identify odd and even functions. Use that to determine Fourier series expansion of the given functions.
4. Apply change of variable method to evaluate double integral

Year : I		**Semester :** I
	ALLIED COURSE II **ALGEBRA**	
Code :		**Credit :**

Objectives :

1. To learn the basic ideas of vector spaces
2. To learn the basic ideas of rank and linear transformation

UNITI

Binomial, Exponential and Logarithmic series (Formulae only) – summation and approximation related problems only.

UNITII

Non-Singular , Symmetric , Skew symmetric, Orthogonal, Hermitian, Skew Hermitian and Unitary matrices – simple properties & problems –Inverse of a non-singularmatrix using adjoint method

UNITIII

Rank of a Matrix – Consistency - Characteristic equation , eigen values ,eigen vectors – Cayley Hamilton's Theorem (proof not needed) –Simple applications only

UNITIV

Vector spaces and its properties –linear independence – Basis & Dimension – Subspaces

UNITV

Linear transformation and its properties –Rank & nullity.

UNIT – VI (Advanced topics only for discussion)

Current Contours: An introduction to power series.

TEXTBOOK(S)

1. T.K.Manichavasam Pillai, T. Natarajan, K.S. Ganapathy, Algebra, Vol.I, S.Viswanathan Pvt Limited, Chennai, 2004 (Unit 1)
2. A.R. Vasistha, Matrices, Krishna Prakeshan Mandir, 24th Edition, 1994-95 (Unit 2 & 3)
3. M.L.Santiago, Modern Algebra (Unit 4 & 5), Arul Publications, Madras, 1993.

REFERENCE(S)

1. Narayanan, T.K. Manicavachagam Pillai & Ramnath, Advanced Mathematics for Engineers & Scientists, S. Viswanathan Publishers Pvt. Ltc., 1994

Course Outcomes : After completing this course, the students will be able to

1. Applying the skills to solve problems in operative algebra.
2. Apply Cayley Hamilton theorem for finding the inverse of square matrices.
3. Find rank and nullity of given linear transformations

YEAR : I		SEMESTER : II
	ALLIED COURSE III **ANALYSIS AND THEORY OF EQUATIONS**	
CODE :		**CREDIT :**

Objectives:

1. To learn the basic ideas of sequences.
2. To learn the basic ideas of series Learn the application of Laplace transform in engineering analysis.

UNITI

Theory of equations-formation of equations- irrational and imaginary roots – relationbetween Roots & coefficients –Reciprocal equations –Reducing roots by a number –multiplying roots by a number.

UNITII

Real Number system – Absolute value of a real number – definition of supremum (LUB) and Infimum (GLB) – Limit of a function.

UNITIII

Definition of a sequence – Convergence and divergence of a sequence – Bounded sequences –Monotonic sequence –Algebra of sequences.

UNITIV

Convergence and divergence of a series –Geometric series –simple tests for convergence of a Series (Comparison tests, ratio test, root test, Leibnitz test) – conditional convergence and absolute convergence of alternating series – Simple problems.

UNITV

Continuous function and its properties – (Simple theorems only) – Uniform Continuity – Rolle's Theorem – Mean Value Theorem – Taylor's Theorem – Maclaurin Series.

UNIT – VI (Advanced topics only for discussion)

Current Contours: Systems of polynomial equations

TEXT BOOK(S)

1. T.K. Manicavachagam Pillai, Analysis, S.V. Publications, Chennai, 1985 (Unit 1 &2).
2. Malik S.C, Mathematical Analysis, Wiley Eastern, New Delhi, 1984.

Course Outcome : After completing this course, the students will be able to

1. Know the foundation of Theory of Equations.
2. Train the students to solve the problems in theory of equations.