**BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALL – 620 024**

**B.Sc. Physics / Chemistry / Industrial Electronics / Geology - Students**

(For the candidates admitted from the academic year 2016-17 onwards)

**ALLIED MATHEMATICS**

**ALLIED COURSE I**

# CALCULUS AND FOURIER SERIES

**Objects :**

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

## UNIT I

Successive Differentiation – $n^{th}$ derivative of standard functions (Derivation not needed) simple problems only-Leibnitz Theorem (proof not needed) and its applications- Curvature and radius of curvature in Cartesian only (proof not needed )–Total differential coefficients (proof not needed) - Jacobians of two & three variables –Simple problems in all these.

## UNIT II

Evaluation of integrals of types

1] $\int \frac{px+q}{ax^2+bx+c}dx$ 2] $\int \frac{px+q}{\sqrt{ax^2+bx+c}}dx$ 3] $\int \frac{dx}{(x+p)\sqrt{ax^2+bx+c}}$

4] $\int \frac{dx}{a+b\cos x}$ 5] $\int \frac{dx}{a+b\sin x}$ 6] $\int \frac{(a\cos x+b\sin x+c)}{(p\cos x+q\sin x+r)}dx$

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] $\int \sqrt{x^2-a^2}\,dx$

## UNIT III

General properties of definite integrals – Evaluation of definite integrals of types

1] $\int_a^b \frac{dx}{\sqrt{(x-a)(b-x)}}$ 2] $\int_a^b \sqrt{(x-a)(b-x)}dx$ 3] $\int_a^b \sqrt{\frac{x-a}{b-x}}dx$

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] $\int_0^{\frac{\pi}{2}} \sin^n x dx$

6] Without proof $\int_0^{\frac{\pi}{2}} \sin^n x \cos^m x dx$ - and illustrations

**UNIT IV**

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

**UNIT V**

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

**TEXT BOOK(S)**


1. S. Narayanan, T.K. Manichavasagam Pillai, Calculus, Vol. I, S. Viswanathan Pvt Limited, 2003
2. S. Arumugam, Isaac and Somasundaram, Trigonometry & Fourier Series, New Gamma Publishers, Hosur, 1999.


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## ALLIED COURSE II

## ALGEBRA, ANALYTICAL GEOMETRY (3D) AND TRIGONOMETRY

**Objects :**

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

**UNIT I**

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

**UNIT II**

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.

**UNIT III**

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 )

**UNIT IV**

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 $\theta$ ($\theta$ - given in radians ) - Expansion of $\sin\theta$, $\cos\theta$ and $\tan\theta$ in terms of powers of $\theta$ (only problems in all the above).

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**UNIT V**

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- Expansion of Inverse hyperbolic functions $\sinh^{-1}x$ ,$\cosh^{-1}x$ and $\tanh^{-1}x$ -Separation of real & imaginary parts of sin(x+iy) ,cos (x+iy) , tan (x+iy) , sinh(x+iy), cosh(x+iy) , tanh(x+iy)

**TEXT BOOK(S)**


1. T.K. Manicavachagam Pillai, T. Natarajan, K.S. Ganapathy, Algebra, Vol. I, S. Viswanathan Pvt Limited, Chennai, 2004
2. S. Narayanan, T.K. Manichavasagam Pillai, S. Viswanathan Pvt Limited, and Vijay Nicole Imprints Pvt Ltd, 2004.
3. T.K.Manickavasagom Pillai, Analytical Geometry (3D) and Vector Calculus, New Gamma Publishing House, 1991.


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## ALLIED COURSE III

## ODE, PDE, LAPLACE TRANSFORMS AND VECTOR ANALYSIS

**Objects :**

1. To learn the basic needs for their major concepts
2. To train the students in PDE and Laplace Transforms

### UNIT I

Ordinary Differential Equation of first order but of higher degree –Equations solvable for x , solvable for $\frac{dy}{dx}$ , Clairaut's form (simple cases only) – Linear equations with constant coefficients – Finding Particular integrals in the cases of $e^{kx}$, sin (kx) , cos (kx) (where k is a constant ), $x^k$ where k is a positive integer , and $e^{kx} f(x)$ where f(x) is any function of x-(only problems in all the above –No proof needed for any formula).

### UNIT II

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 the standard 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) - Lagrange's method of solving Pp+Qq = R ,where P,Q,R are functions of x,y,z – (Geometrical Meaning is not needed)- (only problems in all the above – No proof needed for any formula ).

### UNIT III

Laplace Transform – Definition – L($e^{at}$) ,L( cos(at) ) , L (sin (at) ) L( $t^n$ ) , where n is a positive integer. Basic theorems in Laplace Transforms (formula only)- L [$e^{-st}$ cos bt], L [$e^{-st}$ sin bt ], L [$e^{-st}$ f ( t ) ] – L [ f ( t ) ], L[f' (t ) ], L [f " ( t ) ] –

### UNIT IV

Inverse Laplace Transforms related to the above standard forms – Solving Second Order ODE with constant coefficients using Laplace Transforms.

### UNIT V

Gradient of a vector – directional derivative – unit normal vector - tangent plane – Divergence-Curl – solenoidal & irrotational vectors – Double operators - Properties connecting grad., div., and curl of a vector.

### TEXT BOOK(S)


1. S.Narayanan, Differential Equations, S. Viswanathan Publishers, 1996.
2. S. Narayanan, T.K. Manicavachagam Pillai, Calculus, Vol. II, S. Viswanathan Pvt Limited, 2003
3. M.L. Khanna, Differential Calculus, Jaiprakashnath and Co., Meerut-2004.


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**BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALL – 620 024.**

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

**ALLIED MATHEMATICS**

**ALLIED COURSE I**

**ALGEBRA AND CALCULUS**

**Objects :**

1. To lean the basic concepts in the integration
2. To train the students to solve the problems in Theory of Equations

**UNIT I**

Theory of Equations: Relation between roots & coefficients – Transformations of Equations – Diminishing ,Increasing & multiplying the roots by a constant- Forming equations with the given roots –Rolle's Theorem, Descarte's rule of Signs(statement only) –simple problems.

**UNIT II**

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

**UNIT III**

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

**UNIT IV**

Integration : Evaluation of integrals of types

1] $\int \frac{px+q}{ax^2+bx+c}dx$ 2] $\int \frac{px+q}{\sqrt{ax^2+bx+c}}dx$ 3] $\int \frac{dx}{a+b\sin x}$

4] $\int \frac{dx}{a+b\cos x}$

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

**UNIT V**

Differential Equations: Variables Separables – Linear equations – Second order of types ( a $D^2$ + b D + 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 being an integer (iv ) $e^{Kx}$ f (x )

**TEXT BOOK(S)**


1. T.K. Manickavasagam Pillai & others, Algebra, Volume I, 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.


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## ALLIED COURSE II

## NUMERICAL ANALYSIS AND STATISTICS

**Objects** :

1. To train the students in the numerical problems
2. To train the students in solving statistical problems

### UNIT I

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

### UNIT II

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

### UNIT III

Numerical solution of ODE : Solution by Taylor Series Method , Euler's Method, Runge - Kutta $2^{nd}$ order method- Adam's Predictor Corrector Method and Milne's Predictor Corrector Methods

### UNIT IV

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

### UNIT V

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

### TEXT BOOK(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)

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

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## ALLIED COURSE III

## OPERATIONS RESEARCH

**Objects :**

1. To train the students to solve assignment problems, transportation problems
2. To train the students in network problems.

**UNIT I**

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

**UNIT II**

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

**UNIT III**

Transportation problem : Transportation algorithm –Degeneracy algorithm – Degeneracy in Transportation Problem , Unbalanced transportation problem- Assignment algorithm –Unbalanced Assignment problem .

**UNIT IV**

Sequencing problem : Processing of n jobs through two machines – Processing of n jobs through 3 machines – processing of two jobs through m machines.

**UNIT V**

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

**TEXT BOOK(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, S. Chand and Co., Ltd. New Delhi,
2. Hamdy A. Taha, Operations Research (7th Edn.), McMillan Publishing Company, New Delhi, 1982.

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# BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALL – 620 024

## MATHEMATICAL STATISTICS

**(For the candidates admitted from the academic year 2016-17 onwards)**

**ALLIED COURSE I**

**Objectives**

1. To learn the basic concepts of statistics
2. To learn the basic ideas of statistical datas

**Unit I**

Statistical data – Primary data and Secondary data( definitions only), Formation of frequency distribution, various measures of central tendency – mean ,median, mode, geomentric mean harmonic mean – simple problems – properties of above measures.

**Unit II**

Measures of dispersion – Range quartile deviation mean deviation, standar deviation – their coefficients- merits and demerits (simple problems) – Skewness and kutosis- Karlpearson's coefficients- Bowley's coefficients- simple problems

**Unit III**

Probability- Definition, axiomatic approach to probabity - Additive and Multiplicative laws of Probability ( two variables only) and Conditional probability – simple problems- Concept of random variables – discrete andcontinuous random variables - Distribution functuion, pmf and pdf and their properties- simple problems.

**Unit IV**

Mathematical Expectation – addition and multiplication theorems (two variables only). Moment generating and characteristics functions, their properties. Conditional expectation and conditional variance (simple problems).

**Unit V**

Binomial and poisson distributions – moments, moment generating function cumulant generating function (Simple problems)- fitting binomial distribution and gamma distribution.

**Books for Study:**


1. Gupta S.C. and Kapoor V.K. : Fundamendals of Mathematical Statistics – Sultan Chand & Sons.
2. S.P. Gupta , Statistical Methods (Revised edition 2001)
3. R.S.N. Pillai and Bagavathi ,Practical statistics, Second edition (2013)


**Reference:**


1. Gupta S.C. and Kapoor V.K. : Fundamentals of Applied Statistics – Sultan Chand & Sons.


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## MATHEMATICAL STATISTICS

## ALLIED PRACTICAL

25 marks for records and 75 marks for Practical Examination

Passing minimum for Record – 10 marks (out of 25 marks)
Practical Examination – 30 marks (out of 75 marks)

**Objectives:**

To train the students in solving statistical problems

**Unit I**

Moments of central tendency- A.M, median, G.M and H.M- Measures of Dispersion- quartile deviation, standard deviation and co-efficient of variation- measures of skewness - calculations of first four moments, Central moments, $B_1$, $B_2$.

**Unit II**

Bivariate discrete probability distribution- marginal distribution and condional distribution –Cacculation of mean, variance,covariance, correlation coefficient, expectation - conditional expectations and conditional variance.

**Unit III**

Fitting of binomial, poisson and normal distributions (area method only).

**Unit IV**

Calculation of Karl pearson's coefficient of correlation, Spearman's rank correlation and regression equations.

**Unit V**

Large sample tests- Test of single mean- Difference between means – single proposion and Differece between proposion.
Exact smple test- t' test for single mean, Difference between means, paired t - test chisquar test for goodness of fit and independance of attributes.

**Text Book:**

1 Gupta S.C. and Kapoor V.K. : Fundamendals of Mathematical Statistics – Sultan Chand & Sons.
2 R.S.N. Pillai and Bagavathi ,Practical statistics, Second edition (2013)

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## MATHEMATICAL STATISTICS

## ALLIED COURSE II

**Objectives:**

1. To learn the basic concepts of Discrete continuous distributions
2. To learn the test of significance

**Unit I**

Normal distribution – constants. m, g, f, binomial poisson and chisquare distribution tending to normal statement of central limit theorem. Characteristics functions and its properties. Statement of uniqueness theorem and continuity theorems.

**Unit II**

Continuous distributions – rectangular, exponential, Beta Gamma – distributions sampling distributions, 't' 'F' and chisquare distributions.

**Unit III**

Correlation – Rank correlation, Karl Pearson's correlation co-efficient and its properties. Linear regression and its properties, concept of multiple and partial correlation for three variables only.

**Unit IV**

Test of significance – Definition of null hypothesis, alternative hypothesis, sampling distribution, standard errorand critical region. Type I and Type II errors, one tailed and two tailed tests.Large sample test for single mean, Difference between means, single proportion and difference between proportions.

**Unit V**

Small sample tests – 't' test for single mean. Difference between means. Paired 't' test, Chi- square test for goodness of fit and independence of attributes.

**Text Books**

1. Gupta, S.C. and Kapoor, V K – Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
2. S.P. Gupta , Statistical Methods (Revised edition 2001)

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**BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALL – 620 024**

**B.Sc. STATISTICS - STUDENTS**

**(For the candidates admitted from the academic year 2016-17 onwards)**

**ALLIED COURSE I**

**CALCULUS, LAPLACE TRANSFORM AND FOURIER SERIES**

**Objects :**

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

**UNIT I**

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

**UNIT II**

Evaluation of integrals of types

1] $\int \frac{px+q}{ax^2+bx+c}dx$ 2] $\int \frac{px+q}{\sqrt{ax^2+bx+c}}dx$ 3] $\int \frac{dx}{(x+p)\sqrt{ax^2+bx+c}}$

4] $\int \frac{dx}{a+b\cos x}$ 5] $\int \frac{dx}{a+b\sin x}$ 6] $\int \frac{(a\cos x+b\sin x+c)}{(p\cos x+q\sin x+r)}dx$

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] $\int \sqrt{x^2-a^2}\,dx$

**UNIT III**

General properties of definite integrals – Evaluation of definite integrals of types

1] $\int_a^b \frac{dx}{\sqrt{(x-a)(b-x)}}$ 2] $\int_a^b \sqrt{(x-a)(b-x)}dx$ 3] $\int_a^b \sqrt{\frac{x-a}{b-x}}dx$

Other simple problems. - Evaluation of Double and Triple integrals in simple cases Changing the order and evaluation of the double integration – Beta, Gamma functions.

**UNIT IV**

Laplace Transforms – Inverse Laplace Transforms –Application of Laplace Transform in Solving second order Ordinary differential equation with constant coefficients.

**UNIT V**

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

**TEXT BOOK(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.


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## ALLIED COURSE II

## ALGEBRA

**Objects :**

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

### UNIT I

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

### UNIT II

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

### UNIT III

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

### UNIT IV

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

### UNIT V

Linear transformation and its properties –Rank & nullity .

### TEXT BOOK(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

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## ALLIED COURSE III

## ANALYSIS AND THEORY OF EQUATIONS

**Objects :**

1. To learn the basic ideas of sequences
2. To learn the basic ideas of series

**UNIT I**

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

**UNIT II**

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

**UNIT III**

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

**UNIT IV**

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.

**UNIT V**

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

**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.

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