

Under-Graduate Programme

**Allied Mathematics Courses
(Chemistry)**

**Courses of Study, Schemes of Examinations
& Syllabi
(Choice Based Credit System)**



**THE DEPARTMENT OF MATHEMATICS
(DST – FIST sponsored)
BISHOP HEBER COLLEGE (Autonomous)
(Reaccredited with 'A' Grade (CGPA – 3.58/4.0) by the NAAC &
Identified as College of Excellence by the UGC)
DST – FIST Sponsored College &
DBT Star College
TIRUCHIRAPPALLI – 620 017
TAMIL NADU, INDIA**

2020 – 2021

Allied Mathematics Courses offered to students of Under Graduate Programme in Chemistry

(For the candidates admitted from the year 2020 onwards)

Sem.	Course	Code	Title	Hrs./ week	Credits	Marks		
						CIA	ESA	Total
I	I	U20MAC11	Algebra and Calculus	5	4	25	75	100
II	II	U20MAC22	Vector Calculus and Trigonometry	4	4	25	75	100
II	III	U20MAC23	Differential Equations and Laplace Transforms	4	4	25	75	100

Allied Course I - Algebra and Calculus

Sem. I
Total Hrs. 75

Code: U20MAC11
Credits: 4

General objectives:

On completion of this course, the learner will

1. know the properties of Eigen values, Eigen vectors and the applications of characteristic equations.
2. be able to understand higher order differentiation and to know the applications of differential calculus.
3. know properties of definite integrals and methods of integration of higher powers of trigonometric functions using recurrence relations.

Learning outcomes:

On completion of the course, the student will be able to

1. find the eigen values, eigen vectors of a given matrix.
2. find higher derivatives of given functions.

Algebra

Unit I

Eigen values and Eigen vectors - Cayley-Hamilton Theorem – Diagonalisation of matrices(problems only)

Calculus

Unit II

Differentiation – Definition - Rules for differentiation – Standard forms – Successive differentiation – n^{th} derivatives – Standard forms – Use of Partial fractions – Application of De-Moivre's theorem – Trigonometrical transformations.

Unit III

Leibnitz's theorem (statement only) on the n^{th} differential co-efficient of the product of two functions of x (problems only) – curvature and radius of curvature – cartesian formula for radius of curvature.

Unit IV

Introduction – Methods of Integration – Integrals of the functions involving $a^2 \pm x^2$ - Integrals of functions of the form $\int f(x)^n f'(x) dx$ – Definite Integrals – Properties of definite integrals - Reduction formulae for the three definite integrals :

$\int_0^{\infty} e^{-ax} x^n dx$, $\int_0^{\frac{\pi}{2}} \sin nx dx$ and $\int_0^{\frac{\pi}{2}} \cos nx dx$ where n is a positive integer. (Problems only)

Unit V

The Gamma and Beta functions – Gamma function – recurrence formulae for $\Gamma(n)$ - connection between gamma function and factorials – Beta function – relation between beta and gamma functions – applications of Beta and Gamma functions.

Text Books

1. Dr P Mariappan, Dr V Franklin and Others, Algebra, Calculus and Analytical Geometry of 3D, 1st Edition, New Century Book House, Pvt. Ltd, Chennai.

Unit I	Chapter 1
Unit II & Unit III	Chapter 2
Unit IV	Chapter 3
Unit V	Chapter 4

References

1. T. K. Manichavasagam Pillai, T. Natarajan & K. S. Ganapathy, Algebra (Vol.II) , S.Viswanathan Pvt. Ltd.Reprint 2004.
2. S. Narayanan and T. K. Manichavasagam Pillai, Calculus (Vol. I, II) Viswanathan Printers and Publishers, Reprint 2003.
3. M. K. Venkataraman, Engineering Mathematics, National Publishing Company, 1999.

Allied Course II - Vector Calculus and Trigonometry

Sem. II
Total Hrs. 60

Code : U20MAC22
Credits : 4

General objectives:

On completion of this course, the learner will

1. know the physical applications of derivatives of vectors especially the divergence and curl.
2. be able to understand line integral, surface integral and volume integral, to know their inter-relations and their applications
3. know the expansions of circular and hyperbolic functions and their powers.

Learning outcomes:

On completion of the course, the student will be able to

1. find derivatives of vector functions.
2. evaluate line, surface and volume integrals.
3. expand circular functions as a series.
4. evaluate limits of combination of trigonometric functions.

Vector Calculus

Unit I

Scalar and vector point functions – Direction and magnitude of gradient – Maximum value of directional derivative – Divergence and Curl – Definitions (Solenoidal and Irrotational Vectors) – Vector Identities – Formula involving operator ∇ twice.

Unit II

Vector integration – Line integral – Surface integral – Volume integral.

Unit III

Gauss divergence theorem, Stoke's theorem, Green's theorem (in plane), (No proof is needed-Statements only).

Trigonometry

Unit IV

Expansions for $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ when n is a positive integer – Expansion for $\tan(\theta_1 + \theta_2 + \dots + \theta_n)$ - Expansions for $\cos^n \theta$ and $\sin^n \theta$ in terms of multiples of θ - Expansions of $\sin \theta$, $\cos \theta$ and $\tan \theta$ in terms of θ .

Unit V

Euler's formula - Hyperbolic functions – Relation between the circular and hyperbolic functions – Inverse hyperbolic functions $\sinh^{-1}x$, $\cosh^{-1}x$ and $\tanh^{-1}x$ in terms of logarithmic functions- Separation into real and imaginary parts of $\sin(x + iy)$, $\cos(x + iy)$, $\tan(x + iy)$, $\sinh(x + iy)$, $\cosh(x + iy)$, $\tanh(x + iy)$ and $\tan^{-1}(x + iy)$.

Text Book

1. Dr P. Mariappan, Dr A Emimal Kanaga Pushpam and Others, Vector Calculus and Trigonometry, New Century Book House, Pvt.Ltd, Chennai.

Unit I	Chapter 1
Unit II	Chapter 2
Unit III	Chapter 3
Unit IV	Chapter 4
Unit V	Chapter 5

References

1. S. Narayanan, T.K.Manickavasagam Pillai, Ancillary Mathematics, Vol. III, S. Viswanathan Pvt. Ltd., Reprint 1999.
2. S. Narayanan, T.K.Manickavasagam Pillai, Trigonometry, S.Viswanathan Pvt. Ltd., Reprint 2004.
3. P. Duraipandian, Laxmi Duraipandian and Jayamala Paramasivan, Trigonometry, Emerald Publishers, Reprint 1999.

Allied Course III – Differential Equations and Laplace Transforms

Sem. II
Total Hrs. 60

Code : U20MAC23
Credits : 4

General objectives:

On completion of this course, the learner will

1. know methods of solving differential equations of one dimension and higher dimension.
2. know application of Laplace transforms in solving ordinary differential equations.
3. be able to understand periodic functions through circular functions as Fourier series.

Learning outcomes:

On completion of the course, the student will be able to

1. classify and solve specific types of ordinary and partial differential equations.
2. solve differential and integral equations using Laplace transforms.

Differential Equations

Unit I

Ordinary Differential Equations – First Order and Higher Degree – Equation solvable for $\frac{dy}{dx}$ - Equation solvable for y – Equation solvable for x (simple problems only) – Clairaut's Form. (simple case only)

Unit II

Derivation of Partial Differential Equations by elimination of arbitrary functions – classification of Integrals – some standard types of First Order Partial Differential Equations – Other standard forms.

Laplace Transforms

Unit III

Definition – Condition for the existence of the Laplace Transforms – Properties of Laplace Transforms – Laplace Transform of some standard functions – Some general theorems.

Unit IV

The Inverse Laplace Transforms – Shifting theorem for Inverse Transform – The method of partial fraction can be used to find the Inverse transform of certain functions – Related theorems.

Unit V

Special cases – applications to solutions of Differential Equations.

Text Book

1. Dr R Gethsi Sharmila, Dr R Janet and Others, Differential Equations, Laplace Transforms and Fourier Series, New Century Book House, Pvt. Ltd, Chennai.

Unit I	Chapter 1
Unit II	Chapter 2
Unit III	Chapter 3
Unit IV	Chapter 4
Unit V	Chapter 4

References

1. S. Narayanan and T. K. Manichavasagam Pillai, Calculus (Vol. III) S.Viswanathan Printers and Publishers, Reprint 2004.
2. Vittal.P.R., Allied Mathematics, Margham Publications, Chennai, Reprint 2000.
3. Narasing Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall of India, New Delhi, Fifteenth printing, 1999.