B.Sc. ALLIED MATHEMATICS

SYLLABUS

2009-2010 onwards

PONDICHERRY UNIVERSITY
PUDUCHERRY – 605 014
Syllabus for Allied Mathematics for B.Sc. Physics Main/Chemistry Main/Electronics Main

1. ALLIED:MATHEMATICS –I (FOR PHY/CHE/ELECTRONICS)

2. ALLIED:MATHEMATICS –II (FOR PHY/CHE/ELECTRONICS)
MATHEMATICS – I – (FOR PHYSICS/ CHEMISTRY/ELECTRONICS MAIN)

1. ALGEBRA

   1.1 Matrices.

   1.1.1 Rank of a matrix.

   1.1.2 Consistency of a system of linear non-homogeneous equations (statement only); simple problems.

   1.1.3 Characteristic roots of a square matrix. Evaluation of Eigen values and Eigen vectors.

2. TRIGONOMETRY

   2.1 Hyperbolic Functions.

   2.1.1 Euler’s formula for $e^{i\theta}$. Definition of hyperbolic functions. Relations between the circular and hyperbolic functions. Formulae involving hyperbolic functions.

   2.1.2 Expansion of sinh x and cosh x in powers of x.

   2.1.3 Inverse hyperbolic functions $\sinh^{-1} x$ and $\cosh^{-1} x$ in terms of logarithmic functions.

   2.1.4 Separation into real and imaginary parts.

   \begin{align*}
   \sin (x+iy), \\
   \cos (x+iy), \\
   \tan (x+iy), \\
   \sinh (x+iy), \\
   \cosh (x+iy), \\
   \tanh (x+iy), \\
   \tan^{-1} (x+iy)
   \end{align*}
2.2 Logarithm of a complex number.

2.2.1 Definition of principal value.

2.2.2 Separation into real and imaginary parts.

3. FUNCTIONS OF A COMPLEX VARIABLE

3.1 Limits and continuity.

3.2 Analytic functions.

3.3 Cauchy Riemann equations – derivation and simple problems.

3.4 Harmonic functions.

4. LAPLACE TRANSFORMS

4.1 Definitions, condition for the existence of Laplace transform. Laplace transform of 1, $e^{at}$, $e^{-at}$, $\cos at$, $\sin at$, $\cosh at$, $\sinh at$ and $t^n$ (where $n$ is a positive integer) - simple problems.

4.2 Laplace transform of derivatives (up to second derivative). Laplace transform of integral, first shifting theorem. Change of scale property, Laplace transform of function multiplied by $t$, divisible by $t$, Laplace transform of periodic functions, inverse Laplace transform.

4.3 Solution of ordinary differential equations using Laplace transforms.

5. POLAR CO-ORDINATES

Angle between radius vector and tangent. Angle of intersection of two curves. Pedal equation of a curve.

Note:

10 questions are to be set and any 6 questions are to be answered and all questions carry equal marks.
1. VECTOR CALCULUS

1.1 Vector differentiation.

1.1.2 Scalar point functions: vector point functions.

1.1.3 Derivatives of a vector, derivative of a sum of vectors, derivative of the product of scalar and vector function, derivative of a vector product.

1.1.4 The vector operator del, gradient, divergence and curl of a vector only, simple problems on applications – Laplacian operator (problems should be in Cartesians only)

1.1.5 Vector integration. Gauss’s divergence theorem and stoke’s theorem (statement only) with simple applications.

2. INTEGRATION

2.1 Integration.

2.1.2 Integration of a rational function of the type \( \int \frac{px+q}{ax^2+bx+c} \) \( dx \)

2.1.3 Integration of an algebraic expression involving only one irrational quantity of the form \( \sqrt{ax+b} \), by substitution \( ax+b=z^2 \)

2.1.4 Integrals of the type:

\[ \int \frac{px+q}{\sqrt{ax^2+bx+c}} \] \( dx \)

\[ \int dx / (x+p) \sqrt{ax^2+bx+c} \]

2.1.5 Rational functions of sin x and cos x:

\[ \int dx / (a+ b \cos x); \]

\[ \int dx / (a+ b \sin x); \]
\[ \int (a \cos x + b \sin x + c) \, dx / (p \cos x + q \sin x + r) \]

2.1.6 Integration by trigonometric substitution.

2.1.7 Integrals of the functions

\[ \sqrt{a^2 - x^2}; \]
\[ \sqrt{a^2 + x^2}; \]
\[ \sqrt{x^2 - a^2}; \]

Integrals of the type \( \int \sqrt{ax^2+bx+c} \, dx \)

2.1.8 Evaluation of \( \int e^{ax} \cos bx \, dx, \int e^{ax} \sin bx \, dx \)

2.1.9 Bernoulli’s formula for integration by parts.

2.2 Definite integrals and reduction formulae.

2.2.1 Related definite integrals; general properties.

2.2.2 Reduction formulae for \( \int e^{ax} x^n \, dx, \int \sin^n x \, dx \) and \( \int \cos^n x \, dx \) (n is a positive integer)

2.2.3 Evaluation of \( \int_0^\infty e^{ax} x^n \, dx, \int_0^{\pi/2} \sin^n x \, dx, \int_0^{\pi/2} \cos^n x \, dx \) (n is a positive integer)

2.2.4 Rule for writing down \( \int_0^{\pi/2} \sin^m x \cos^m x \, dx \) and illustrations.

2.2.5 Evaluation of integrals of the type

\[ \int_a^b \sqrt{(x-a)(b-x)} \, dx , \]
\[ \int_a^b dx/\sqrt{(x-a)(b-x)}, \quad (b>0) \]
\[ \int_a^b \sqrt{(x-a)/(b-x)} \, dx , \]
\[ \int_0^{\pi/2} dx/ (a^2 \cos^2 x + b^2 \sin^2 x) \]
2.3 Fourier Series.

2.3.1 Definition: Finding Fourier coefficients for a given periodic function with period $2\pi$.

2.3.2 Odd and even functions. Half range series.

2.4 Multiple integrals.

2.4.1 Definition – Evaluation of the double and triple integrals in simple cases.

2.5 Ordinary Differential Equations:

2.5.1 Equations of the first order but not of the first degree. Equations solvable for $dy/dx$, equations solvable for $y$, equations solvable for $x$, Clairaut’s form (simple cases only).

2.5.2 Linear equations with constant coefficients, evaluation of the particular integral of the equation – special methods: $e^{ax}$, where $a$ is any constant; for $\sin ax$ or $\cos ax$, where $a$ is any constant; for $x^k$, where $k$ is a positive integer; for $e^{ax}$ $f(x)$, where $f(x)$ is a polynomial of degree $m$.

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