

# B.Sc. ALLIED MATHEMATICS

## SYLLABUS

2009-2010 onwards



# PONDICHERY UNIVERSITY

PUDUCHERRY – 605 014

# B.Sc. ALLIED MATHEMATICS

**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)

## SEMESTER I – ALLIED PAPER I

### 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.

$\sin (x+iy),$   
 $\cos (x+iy),$   
 $\tan (x+iy),$   
 $\sinh (x+iy),$   
 $\cosh (x+iy),$   
 $\tanh (x+iy),$   
 $\tan^{-1} (x+iy)$

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  $1$ ,  $e^{at}$ ,  $e^{-at}$ ,  $\cos at$ ,  $\sin at$ ,  $\sinh at$ ,  $\cosh at$  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.

## SEMESTER II – ALLIED PAPER II

### MATHEMATICS – II (FOR PHYSICS/ CHEMISTRY/ELECTRONICS MAIN)

#### 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  $\int (px+q) / (ax^2+bx+c) dx$

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:

$$\int (px+q) / \sqrt{ax^2+bx+c} dx$$

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

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  $\int_0^\infty e^{-x} x^n dx$ ,  $\int_0^{\pi/2} \sin^n x dx$ ,  $\int_0^{\pi/2} \cos^n x dx$  (n is a positive integer)

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

2.2.5 Evaluation of integrals of the type

$$\int_a^b \sqrt{(x-a)(b-x)} dx ,$$

$$\int_a^b dx / \sqrt{(x-a)(b-x)} , (b>0)$$

$$\int_a^b \sqrt{(x-a)/(b-x)} dx ,$$

$$\int_0^{\pi/2} dx / (a^2 \cos^2 x + b^2 \sin^2 x)$$

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 positive integer ;  
for  $e^{ax} f(x)$ , where  $f(x)$  is a polynomial of degree  $m$ .

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