B.Sc. ALLIED MATHEMATICS

SYLLABUS

2009-2010 onwards

PONDICHERRY 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 Bernouli'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 2π.

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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