Applied Mathematics – I (New Syllabus) (B. Tech and B. Chem)

	Course Code:	**Course Title: Applied Mathematics I**	**Credits = 4**		
			L	**T**	**P**
	Semester: I	**Total contact hours: 60**	**3**	**1**	**0**
List of Prerequisite Courses					
	HSC Standard Mathematics				
List of Courses where this course will be prerequisite					
	This is a basic Mathematics course. This knowledge will be required in almost all subjects later on				
Description of relevance of this course in the B. Chem. Engg. Program					
This is a basic Mathematics course. This knowledge will be required in almost all subjects later on. This knowledge is also required for solving various mathematical equations that need to be solved in several chemical engineering courses such as MEBC, momentum transfer, reaction engineering, separation processes, thermodynamics, etc.					
	Course Contents (Topics and subtopics)		**Reqd. Hours**		
1	Solutions of system of linear equations (Gauss-elimination, LU-decomposition etc.) Numerical methods for solving non-linear algebraic / transcendental etc. Newton's method, Secant, Regula Falsi, Jacobi Numerical solution set of linear algebraic equations: Jacobi, Gauss Siedel, and under / over relaxation methods		10		
2	Interpolation and extrapolation for equal and non-equal spaced data (Newtons Forward, Newtons backward and Lagrange) Numerical integration (trapezoidal rule, Simpson's Rule)		10		
3	Probability of Statistics: Functions of random variables, probability distribution functions, expectation, moments Statistical hypothesis tests, t-tests for one and two samples, F-test, χ^2-test Statistical Methods for Data Fitting: Linear, multi-linear, non-linear regression		10		
4	Differential Calculus: Higher order differentiation and Leibnitz Rule for the derivative, Taylor's and Maclaurin's theorems, Maxima/Minima, convexity of functions, Radius of curvature;		10		
5	Functions of two or more variables, Limit and continuity, Partial differentiation, Total derivatives, Taylor's theorem for multivariable functions and its application to error calculations, Maxima/Minima, Jacobian.		10		

6	Integral Calculus: Beta and Gamma functions, Differentiation under the integral sign, surface integrals, volume integrals	10
List of Text Books/ Reference Books		
	Advanced Engineering Mathematics, Erwin Kreyszig, John-Wiely.	
	Advanced Engineering Mathematics S. R. K. Iyengar, R. K. Jain, Narosa	
	Introductory Methods Of Numerical Analysis, S. S. Sastry, PHI.	
	A First Course in Probability, Sheldon Ross, Pearson Prentice Hall	
	Probability and Statistics in Engineering , W.W. Hines, D. C. Montgomery, D.M. Goldsman, John-Wiely	

CO for Applied Mathematics – I (New Syllabus) (B. Tech and B. Chem)

CO1: Students should be able to explain basic concepts of matrix theory, numerical techniques, probability distributions and calculus of single variable (K1, K2).

CO2: Students should be able to apply basic concepts of differential calculus to solve problems related to extremum, approximations, curvature etc. (K3, K4)

CO3: Students should be able to apply basic numerical techniques to solve linear and nonlinear equations. (K3, K4)

CO4: Students should be able to do basic statistical inference, linear and nonlinear regression analysis and design of experiments. (K3, K4)

CO5: Students should be able to effectively choose appropriate mathematical and statistical concepts to solve various real world problems. (K4, K5)

Applied Mathematics – II (New Syllabus) (B.Chem)

	Course Code: MAT 1102	**Course Title: Applied Mathematics II**	**Credits = 4**		
			L	**T**	**P**
	Semester: II	**Total contact hours: 60**	**3**	**1**	**0**
List of Prerequisite Courses					
	XIIth Standard Mathematics, Applied Mathematics - I				
List of Courses where this course will be prerequisite					
	This is a basic Mathematics course. This knowledge will be required in almost all subjects later on				
Description of relevance of this course in the B. Chem. Engg. Program					
This is a basic Mathematics course. This knowledge will be required in almost all subjects later on. This knowledge is also required for solving various mathematical equations that need to be solved in several chemical engineering courses such as MEBC, momentum transfer, reaction engineering, separation processes, thermodynamics, etc.					
	Course Contents (Topics and subtopics)		**Reqd. Hours**		
1	Differential Equations: Solution of Higher order ODE with constant and variable coefficients and its applications to boundary and initial value problems, Series solution of differential equations, Bessel functions, Legendre Polynomials, Error function. Partial Differential Equations, Classification of higher order PDEs, Solution of parabolic equation using separation of variables		20		
2	Numerical methods for solution of first and higher order ODEs (initial values and boundary value problems) using single step methods (RK, Euler's explicit and implicit methods). Multi-Step methods (predictor – corrector methods etc), Solution of Stiff ODEs, Adaptive step size, Shooting method		20		
3	Finite difference methods: Forward difference, backward difference, central differences, application of finite difference methods to ODE Boundary value problem, and PDE (parabolic, elliptic and hyperbolic)		20		
List of Text Books/ Reference Books					
	Advanced Engineering Mathematics, Erwin Kreyszig, John-Wiely				
	Advanced Engineering Mathematics S. R. K. Iyengar, R. K. Jain, Narosa.				
	Elements of *Applied Mathematics*. Volume 1, P.N.*Wartikar* and J.N.*Wartikar,* Pune Vidyarthi Graha				
	Introductory Methods Of Numerical Analysis, S. S. Sastry, PHI.				
	Numerical Solution of differential Equations, M. K. Jain, Wiley Eastern.				

CO for Applied Mathematics – II (New Syllabus) (B.Chem)

CO1: Students should be able to solve second and higher order ODEs by various analytical and numerical techniques. (K1, K2)

CO2: Students should be able to classify two dimensional PDEs and obtain the solution of parabolic equation by using analytical methods (K1, K2)

CO3: Students should be able to understand various concepts of finite difference methods for solving ODEs and PDEs. (K3, K4)

CO4: Students should be able to understand the derivation of forward, backward and central difference schemes for ordinary and partial derivatives and also should be able to understand the stability of the numerical schemes. (K3, K4)

CO5: Students should be able to apply various finite difference schemes for solving boundary value problem for ODE and initial-boundary value problem for PDE for some practical problems. (K5)

Applied Mathematics – II (New Syllabus) (B.Tech)

	Course Code:	**Course Title: Applied Mathematics II**	**Credits = 4**		
			L	**T**	**P**
	Semester: II	**Total contact hours: 60**	**3**	**1**	**0**
List of Prerequisite Courses					
	XIIth Standard Mathematics, Applied Mathematics – I				
List of Courses where this course will be prerequisite					
	This is a basic Mathematics course. This knowledge will be required in almost all subjects later on				
Description of relevance of this course in the B. Tech. Program					
This is a basic Mathematics course. This knowledge will be required in almost all subjects later on. This knowledge is also required for solving various mathematical equations that need to be solved in several chemical engineering courses such as MEBC, momentum transfer, reaction engineering, separation processes, thermodynamics, etc.					
	Course Contents (Topics and subtopics)		**Reqd. Hours**		
1	Differential Equations: Solution of Higher order ODE with constant and variable coefficients and its applications to boundary and initial value problems, Series solution of differential equations, Bessel functions, Legendre Polynomials, Error function. Fourier series, Laplace Transforms and their application in differential equation (both ODEs PDEs). Partial Differential Equations, Classification of higher order PDEs, Solution of parabolic equation using separation of variables		20		
2	Numerical methods for solution of initial values problems using RK method, Euler's method and Taylor series method.		20		
3	Finite difference methods: Forward difference, backward difference, central differences, application of finite difference methods to ODE Boundary value problem.		20		
List of Text Books/ Reference Books					
	Advanced Engineering Mathematics, Erwin Kreyszig, John-Wiely				
	Advanced Engineering Mathematics S. R. K. Iyengar, R. K. Jain, Narosa.				
	Elements of *Applied Mathematics*. Volume 1, P.N.*Wartikar* and J.N.*Wartikar,* Pune Vidyarthi Graha				
	Introductory Methods Of Numerical Analysis, S. S. Sastry, PHI.				
	Numerical Solution of differential Equations, M. K. Jain, Wiley Eastern.				

CO for Applied Mathematics – II (New Syllabus) (B.Tech)

CO1: Students should be able to solve second and higher order ODEs by various analytical and numerical techniques. (K1, K2)

CO2: Students should be able to classify two dimensional PDEs and obtain the solution of parabolic equation by using analytical methods (K1, K2)

CO3: Students should be able to understand various concepts of finite difference methods for solving ODEs and PDEs. (K3, K4)

CO4: Students should be able to understand the derivation of forward, backward and central difference schemes for ordinary and partial derivatives and also should be able to understand the stability of the numerical schemes. (K3, K4)

CO5: Students should be able to apply various finite difference schemes for solving boundary value problem for ODE and initial-boundary value problem for PDE for some practical problems. (K5)

Computer Applications (B. Tech.)

	Course Code: MAP 1201	Course Title: Engineering Application of Computers (50 Marks)	Credits = 2		
			L	T	P
	Semester: III	Total contact hours: 64	0	0	4
List of Prerequisite Courses					
List of Courses where this course will be prerequisite					
Description of relevance of this course in the B. Tech. (Textile) Programme					
Students will understand the basics of computer programming. The students will get exposure to the use of Excel for Statistical Analysis for engineering applications, doing statistical computations such as regression, testing of hypothesis using R Programming language. The students will learn basics of C-programming that will enhance their ability in scientific computation in engineering disciplines.					

	Course Contents (Topics and subtopics)	Reqd. hours
1	Basic Introduction to Spreadsheet Programmes, Plotting Graphs of Functions and Data Plotting.	4
2	Exploring Basic Statistics, Hypothesis Testing with Spreadsheet.	4
3	Numerical Solution of Linear and Non-Linear Equations.	4
4	Basic Introduction to R and Rstudio, Data Management in R.	4
5	Exploring Distribution Function in R.	4
6	Hypothesis Testing in R.	4
7	Basic Regression Analysis in R	4
8	What is C-programming? Data Types, Variables, Constants, Arithmetic Operations,	4
9	Input-Output Statements, Expressions and Expression Evaluations, Type Conversions.	4
10	Making Decisions-if and switch statement, Repetition Statements-For Loop, While and Do-While Loops, Nested Loops,	4
11	Use of Break, Continue and Goto in Loops, File Input-Output statements and its use.	4

12	Functions- User Defined functions, Calling Function and passing arguments, Arrays- Definition, Accessing and Storing elements,	8
13	Concept of Multi-dimensional Arrays, Array and Functions.	4
14	String Manipulation. Basic of Structures and unions.	4
15	Dynamic Memory allocation.	4

CO for Computer Applications (B. Tech.)

CO1: Able to carry out basic statistical analysis using Excel including hypothesis testing (K3, K5,A3)

CO2: Able to solve linear and nonlinear equations numerically using Excel (K3, K5, A3)

CO3: To understand the basic features of R Programming and its use in data analysis problems (K3, A3)

CO4: Students should be able to do basic statistical inference, linear and nonlinear regression analysis using R (K3, A3, K4)

CO5: Students should be able to explain basic concepts of c programming and get exposure to the syntax and loop and array concepts (K1, K2)

CO6: Able to write programs using user defined functions and dynamic memory allocation (K3, K4, K5)

Mathematics & Statistics – I (B. Pharm)

	Course Code:PHT1601	**Course Title: Mathematics & Statistics – I**	**Credits = 3**		
			L	**T**	**P**
	Semester: I	**Total contact hours: 45**	**2**	**1**	**0**
List of Prerequisite Courses					
	HSC Mathematics				
List of Courses where this course will be prerequisite					
	Mathematics & Statistics – II, Biopharmaceutics and Pharmacokinetics, Biostatistics, Computer Laboratory				
Description of relevance of this course in the B.Pharm Program					
To train the students with respect to basics of mathematics and statistics and its application in Pharmaceutical Sciences					

	Course Contents (Topics and subtopics)	**Reqd. hours**
1	**Matrices and Determinants:** Types of matrices, transpose of a matrix, inverse of a matrix, determinant of a matrix and its properties, elementary row and column operations on matrices, rank of a matrix, solution of system of linear equations using Gauss elimination methods, inverse method and Cramer's rule	06
2	**Differential calculus:** Rolle's and Lagrange's mean value theorems, Successive derivatives, Leibnitz rule for nth derivative, Taylor's and Maclaurins series expansions. Functions of two/three and several variables, partial differentiation, Euler formula and its applications, Local and absolute maxima-minima and its applications to least square problems and curve fitting. Notion of improper integral, its convergence and applications to Gamma-Beta functions	12
3	**Integral calculus:** Properties of integrals, integration by parts, introduction to double and triple integrals	06
4	Numerical Solutions of non-linear equations using Newton-Raphson, Secant and Regula-Falsi Methods	03

5	Lagrange Interpolations formula, Newton's backward and forward interpolation formulae, Trapezoidal rule, Simpsons 1/3rdand 3/8th rules of integrations and its applications	06
6	Solution of 1st and second order ordinary differential equations and their applications to chemical reactions and biopharmaceutics (Rate constants, Order of reaction: first order reaction, second order reaction, pseudo-first order reactions, Arrhenius equation), Exponential decay (half life calculations, drug elimination), Noyes-whitney equation, Ficks law of diffusion, Hixson-Crowell model, Higuchi, peppas dissolution models	12
List of Text Books/ Reference Books		
1	A Textbook of B.Pharmaceutical Mathematics (Remedial Mathematics Vol.I and Vol. II). Bali NP, Gupta PN, Gandhi CP	
2	Pharmacy and Biotechnology Mathematic. Khan RA, Khan A	
3	Biopharmaceutics and Pharmacokinetics. Brahmankar DM, Jaiswal SB	
4	Advanced Engineering Mathematics. Jain RK, Iyengar SRK, 3rd Edition, 2007, Naros	
5	Elements Of Applied Mathematics Wartikar PN, Wartikar JN ,6th Edition, 1977 Pune VidyarthiGraha	
6	Advanced Engineering Mathematics. Kreyszig E. 9th Edition, 2005, Wiley International	
7	Advanced Engineering Mathematics. Zill DG, Warren S. Wright, 4th Edition	

CO for Mathematics & Statistics-I (B. Pharm)

CO1: Students should be able to explain basic concepts of matrices, determinants, differential and integral calculus. (K1, K2)

CO2: Students should be able to solve the problems related to matrices and determinants such as solution of linear equations, eigenvalues and eigenvectors. (K3, K4)

CO3: Students should be able to apply basic concepts of differential calculus to solve problems related to extremum, approximations, least squares fitting etc. (K3, K4)

CO4: Students should be able to solve problems related to length and area under a curve, centre of gravity and moment of inertia by using basic concepts of integral calculus. (K3, K4)

CO5: Students should be able to effectively choose appropriate mathematical techniques to solve their domain related problems. (K4, K5)

Mathematics & Statistics – II (B. Pharm)

	Course Code: PHT1604	**Course Title: Mathematics & Statistics – II**	**Credits = 3**		
			L	**T**	**P**
	Semester: II	**Total contact hours: 45**	**2**	**1**	**0**
List of Prerequisite Courses					
	HSC Mathematics, Mathematics & Statistics – I				
List of Courses where this course will be prerequisite					
	Biopharmaceutics and Pharmacokinetics, Biostatistics, Computer Laboratory				
Description of relevance of this course in the B. Pharm. Program					
To train the students with respect to basics of mathematics and statistics and its application in Pharmaceutical Sciences					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	Arithmetic and Geometric means, median and mode, range, deviation, mean and standard deviation, coefficient of variation, moments, skewness and kurtosis		01		
2	**Probability Distribution:** Discrete and continuous random variables, probability distribution functions, expectation of random variables, mean, variance and moments of random variables, moment generating function, binomial and geometric distribution, Poisson distribution, normal distribution, uniform and gamma-beta distributions		14		
3	**Population and sampling, determination of sample size**		03		
4	**Hypothesis Testing:** Introduction to hypothesis testing, Z-test, Students t-test for single sample multiple samples, paired t-test, chi-square distribution		09		
5	**Design of Experiments**: ANOVA (One way ANOVA and Two way ANOVA) Application in identification of statistical difference between responses, selection of appropriate test for pharmacokinetic and pharmacodynamic response analysis		09		
6	**Correlation and Regression**: linear and nonlinear regression, multilinear regression, correlation, calculation of similarity factor (f2 value) and difference factor (f1 value) Application to Invitro dissolutions analysis, IVIVC		09		
List of Text Books/ Reference Books					
1	A First Course In Probability. Sheldon Ross, 6th Edition, 2002, Prentice Hall				
2	Statistical Methods. Gupta SP, 2nd Edition, 1969, S. Chand & Co.				
3	Theory and practice of Industrial Pharmacy. Lachmen, 3rd Edition				
4	Biopharmaceutics and Pharmacokinetics. Brahmankar DM, Jaiswal SB				

5	Mathematics-for-Pharmacy Students Vol. I (Calculus.). Gujar K.	
6	Mathematics-for-Pharmacy Students Vol. II (Stat.). Gujar K.	
7	Miller & Freund's Probability And Statistics For Engineers. Johnson R, Miller I, Freund J, 7th Edition, 2005, Pearson Education	
8	Pharmaceutical Statistics: Practical And Clinical Applications. Bolton S, Bon C, 4th Edition, 2004, Marcel Dekker	
9	Essential Statistics For The Pharmaceutical Sciences. Rowe P, 1st Edition, 2007, John Wiley Sons ltd.	
10	Pharmaceutical Statistics. Jones D,1st Edition, 2002, Pharmaceutical Press UK	
11	Applied Statistics And Probability For Engineers. Douglas CM, Alasdair GM, Nairn G, Runger, 4th Edition, 2006, Wilely	

CO for Mathematics & Statistics-II (B. Pharm)

CO1: Students should be able to explain the various probability distributions, basics of statistical inference and regression analysis. (K1, K2)

CO2: Students should be able to do basic statistical inference, linear and nonlinear regression analysis and design of experiments. (K3, K4)

CO3: Students should be able to analyze the data using parameteric and nonparametric statistical hypothesis testing procedures. (K3, K4)

CO4: Students should be able to solve problems related to point and interval estimation by using the concepts of sampling distributions. (K3, K4)

CO5: Students should be able to effectively choose appropriate mathematical techniques to solve their domain related data analysis problems. (K4, K5)