Department of Artificial Intelligence and

Department of Computer Science and Engineering

B. Tech. I (AI/CSE) Semester – I Fundamentals of Engineering Mathematics MA105	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	Accept the challenge to solve the problem with Mathematics.
CO2	Apply the knowledge of curve tracing to solve problem of engineering.
CO3	Identify, formulate and analyze complex engineering and affiliated field problems, specifically the differential equation concept in different engineering field.
CO4	Apply the knowledge of mathematics for model and analyze computational processes using analytic and combinatorial methods
CO5	Design solutions engineering industrial problems with effective mathematical skill.

2.	Syllabus	
	DIFFERENTIAL CALCULUS	**(09 Hours)**
	Differentiation of Hyperbolic and Inverse Hyperbolic functions. Successive Differentiation, standard forms, Leibnitz's theorem and applications, Power series, Expansion of functions, Taylor's and Maclaurin's series. Curvature, Radius of curvature for Cartesian curve with application.	
	PARTIAL DIFFERENTIAL CALCULUS	**(09 Hours)**
	Partial differentiation, Euler's theorem for homogeneous function, Modified Euler's theorem, Taylor's and Maclaurin's series for two variables. Tangent plane and Normal line, Error and Approximation, Jacobians with properties, Extreme values of function of two variables, Lagrange's methods of undetermined multipliers.	
	CURVE TRACING	**(06 Hours)**
	Cartesian, polar and parametric form of standard curves.	
	ORDINARY DIFFERENTIAL EQUATION	**(09 Hours)**
	Reorientation of differential equation first order first degree, exact differential equation and Integrating factors, first order higher degree odes, solvable for p, y and x, Solution of homogenous equations higher order, complementary functions, Particular Integrals, Linear differential equation with variable coefficient, Cauchy's Euler and Legendre's equation with variable coefficient, Method of variation of parameters.	
	APPLICATION OF DIFFERENTIAL EQUATION (Mathematical Modelling)	**(06 Hours)**
	Modelling of Realworld problems particularly Engineering System, Electrical network models (LCR), spread of epidemic (SI, SIS, SIR), Newton's Law of cooling, Compartment modelling,	

	Bending of beam models.	
	SERIES SOLUTION AND SPECIAL FUNCTIONS	**(06 Hours)**
	Regular point, Singular point, series solution of ODE of 2nd order with variable coefficient with special emphasis to differential equation of Legendre's and Bessel's for different cases of roots of indicial equations.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Tutorial will be related to Differential Calculus.
2	Tutorial will be on Radius of curvature for Cartesian curve with application.
3	Tutorial will be on different examples of Partial Differential Calculus.
4	Tutorial will be on Extreme values of function of two variables.
5	Tutorial will be on Curve Fitting.
6	Tutorial will cover Ordinary differential equations.
7	Tutorial will be on examples of Higher order Ordinary differential equations.
8	Tutorial will be on examples of Application of Ordinary differential equations.
9	Tutorial will be on Series solution with ordinary point
10	Tutorial will be on with Series solution with regular singular point

4.	**Books Recommended**
1	James Stewart, "Calculus", Thomson Asia, Singapore, 2003.
2	Kreyszig E., "Advanced Engineering Mathematics", John Wiley & Sons, Singapore, Int. Student Ed. 2015.
3	Wiley C. R., "Advanced Engineering Mathematics", McGraw Hill Inc., New York Ed. 1993.
4	HilderbandF. B., "Methods of Applied mathematics", PHI, New Delhi, 1968.
5	Ramana B. V., "Higher Engg. Mathematics", The McGraw-Hill Inc., New Delhi, 2007.
	Additional Reference Book
1	Srimanta Pal, Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, New Delhi, 2015
2	Bali and Iyengar, "Engineering Mathematics", Laxmi Publications, New Delhi, 2004
3	Mary L. Boas, "Mathematical Methods in the Physical Sciences", John Wiley & Sons, Ed.2005

B. Tech. I (AI/CSE) Semester – II Linear Algebra, Statistics and Calculus MA106	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	accept the challenge to solve the problem with statistics
CO2	apply the knowledge of Linear Algebra to solve problem of engineering.
CO3	identify, formulate and analyze complex engineering and affiliated field problems, specifically the Partial differential equation concept in different engineering field
CO4	apply the knowledge of vector calculus and analyze computational processes
CO5	design solutions to work on engineering industrial problems with effective mathematical skill.

2.	Syllabus	
	PROBABILITY THEORY AND RANDM PROCESS	**(09 Hours)**
	Fundamentals of Probability Theory: - views of probability, Random variables and Joint distributions, Marginal distribution, Conditional probability, Conditional independence, Expectation and variance, Probability distributions Central limit theorem, Functions of random variable, Sum of independent random variable, Correlation and regression, Random process, Stationary random process, Autocorrelation and cross correlation, Ergodic process, Markov process, Birth and death process, Poisson process, Markov chain, Chapman Kolmogorov theory, Spectral analysis of random processes, power spectral density.	
	ESTIMATION AND STATISTICS	**(08 Hours)**
	Sampling theory, Population and sample, Statistical interference, Sampling distribution, Sample mean, Bias estimation, Unbiased estimator, Confidence interval, Point estimation and interval estimates, Statistical decision, Hypothesis testing, Statistical hypotheses, Null hypotheses, Significance test, Type I and types II errors, Level of significance, One tail and two tailed test, Chi square test, Maximum likelihood estimate, Least square estimate, MAP estimate, Minimum mean square estimate.	
	INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATION	**(09 Hours)**
	Introduction to Partial differential equation, Formation of partial differential Equation, Partial differential Equation of first order, Linear partial differential equation of first order (Pp + Qq =R) and method of obtaining its general solution, Non-linear partial differential equation of first order f(p, q)=0, f(z, p, q)=0, f(x, p)= g(y, q), z= px + qy + f(p,q).	
	BASIC CONCEPTS OF VECTOR CALCULUS	**(08 Hours)**

	Scalar and vector point function, differential operator, gradient, directional derivative, divergence, curl and Laplacian operator with their properties.	
	LINEAR ALGEBRA	**(11 Hours)**
	Linear systems, Elementary row and column transformation, rank of matrix, consistency of linear system of equations, Linear Independence and Dependence of vectors, Gauss Elimination method, Gauss-Jorden Method, Gauss-Jacobi Iteration Method; Vectorspaces, Subspace, Field, Ring, Norm and distance, Linear Mapping, Orthogonality, Eigenvectors and Eigenvalues, Least square, Least square data fitting, Constrained least square applications.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Tutorial will be related to Probability theory.
2	Tutorial will be on Randomness.
3	Tutorial will be on Estimation theory.
4	Tutorial will be onPartial differential Equation.
5	Tutorial will be onspecial type of Partial differential Equation.
6	Tutorial will covered on basics of Vector calculus.
7	Tutorial will be on examples of divergence, curl and Laplacian operator.
8	Tutorial will be on examples Liner algebra.
9	Tutorial will be on Eigenvectors and Eigen values.
10	Tutorial will be on Least square, Least square data fitting, Constrained least square applications

4.	**Books Recommended**
1	Kreyszig E., “Advanced Engineering Mathematics”, John Wiley & Sons, Singapore, Int. Student Ed. 2015.
2	Wiley C. R., “Advanced Engineering Mathematics”, McGraw Hill Inc., New York Ed. 1993.
3	Gilbert Strang, “Introduction to Linear Algebra”, Wellesley Cambridge Press, 4th Ed., 2009.
4	David C. Lay, “Linear Algebra and its applications”, 3rd Ed., Pearson, 2006.
5	A. Papoulis and S. U. Pillai, “Probability, Random Variables and Stochastic Processes”, 4th Ed., Mc-Graw Hill, 2002.
	Additional Reference Book
1	Ramana B. V., “Higher Engg. Mathematics”, McGraw-Hill Inc., New Delhi, 2007.
2	Srimanta Pal, Subodh C. Bhunia, “Engineering Mathematics”, Oxford University Press, New Delhi, 2015.
3	Mary L. Boas, “Mathematical Methods in the Physical Sciences”, John Wiley & Sons, Ed.2005

Department of Chemical Engineering

B. Tech. I (Chemical) Semester – I Mathematics MA107	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	Estimate the area and volume using integral evaluation techniques.
CO2	Explain various methods for solving ordinary differential equations and their importance to engineering problems.
CO3	Explain the fundamentals of partial differential equations and methods for solving linear and non-linear PDE of the first order.
CO4	Explain the fundamental concepts of vector calculus and their role in applied mathematics.
CO5	Apply special functions and their applications to evaluate some proper and improper integrals.
CO6	Explain the basics and importance of the Laplace transform and Fourier transform.

2.	Syllabus:	
	MULTIPLE INTEGRAL	**(07 Hours)**
	Reorientation of concepts of integrals, Double and Triple integrals, Evaluation techniques, Change of order of Integration, Change of variable, Application of double and triple integrals for evaluation of area and volume.	
	ORDINARY DIFFERENTIAL EQUATION	**(10 Hours)**
	Reorientation of differential equation of first order first degree, Exact differential equation and Integrating factors, Ordinary differential equation of first order higher degree, solvable for p, y and x, Solution of homogenous equations of higher order, Complementary functions, Particular Integrals, Linear differential equation with variable coefficient, Cauchy's Euler and Legendre's equation with variable coefficients.	
	INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATION	**(07 Hours)**
	Basics of partial differentiation, Introduction to partial differential equation, Formation of partial differential Equation, Partial differential Equation of first order, Linear partial differential equation of first order (Pp + Qq =R) and method of obtaining its general solution, Non-linear partial differential equation of first order f(p, q)=0, f(z, p, q)=0, f(x, p)= g(y, q), z= px + qy + f(p, q).	
	VECTOR CALCULUS	**(07 Hours)**

	Scalar and vector point function, Differential operator, Gradient, Directional derivative, Divergence, Curl and Laplacian operator with their properties, Line integral, Surface Integral, Volume integral, Green's, Gauss and Stokes theorem (Only statement) and application.	
	BETA, GAMMA AND HYPERBOLIC FUNCTION	**(04 Hours)**
	Beta and Gamma function with their properties and duplications formula without proof. Introduction of hyperbolic functions, Differentiation of hyperbolic and inverse hyperbolic functions.	
	LAPLACE AND FOURIER TRANSFORM	**(10 Hours)**
	Laplace transform, Existence theorem, Basic properties, Laplace transform of derivatives and integrals, Inverse Laplace transform and properties, Convolution Theorem, Applications to solve simple linear and simultaneous differential equations. Introduction to Fourier transform, Basic properties.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Tutorial will be related to Multiple Integral.
2	Tutorial will be on Application of Multiple Integral
3	Tutorial will cover Ordinary differential equations.
4	Tutorial will be on examples of Higher order Ordinary differential equations.
5	Tutorial will be on examples of Application of Ordinary differential equations.
6	Tutorial will be on Partial differential Equation.
7	Tutorial will be on special type of Partial differential Equation.
8	Tutorial will be on examples of vector calculus.
9	Tutorial will be on examples of Beta Gama function
10	Tutorial will be on Laplace and Fourier transform

4.	**Books Recommended**
1	Kreyszig E., "Advanced Engineering Mathematics", John Wiley & Sons, Singapore, Int. Student Ed. 2015
2	O'Neel Peter., "Advanced Engg. Mathematics", Thompson, Singapore, Ind. Ed. 2002.
3	Wiley C. R., "Advanced Engineering Mathematics", McGraw Hill Inc., New York Ed. 1993.
4	Ramana B. V., "Higher Engg. Mathematics", The MaGraw-Hill Inc., New Delhi, 2007.

Department of Electrical Engineering

B. Tech. I (Electrical) Semester – I Mathematics-I MA113	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	Apply the concept of differential calculus to engineering problems.
CO2	Evaluate the solution of ordinary differential equations of first order.
CO3	Analyze the nature of ODE of 2nd order and find its series solution.
CO4	Develop the mathematical models for real world problems and their solutions.
CO5	Develop basic concept of the linear algebra to engineering problems.
CO6	Apply the concept of differential calculus to engineering problems.

2.	Syllabus:	
	DIFFERENTIALCALCULUS	**(10 Hours)**
	Differentiation of Hyperbolic and Inverse Hyperbolic functions. Successive Differentiation, standard forms, Leibnitz's theorem and applications, Power series, Expansion of functions, Taylor's and Maclaurin's series. Curvature, Radius of curvature for Cartesian curve with application.	
	ORDINARY DIFFERENTIALEQUATION	**(10 Hours)**
	Reorientation of differential equation first order first degree, exact differential equation and Integrating factors, first order higher degree odes, solvable for p, y and x, Solution of homogenous equations higher order, complementary functions, Particular Integrals, Linear differential equation with variable coefficient, Cauchy's Euler and Legendre's equation with variable coefficient, Method of variation of parameters.	
	APPLICATION OF DIFFERENTIAL EQUATION (Mathematical Modelling)	**(06 Hours)**
	Modeling of Real world problems particularly Engineering System, Electrical network models (LCR), spread of epidemic (SI, SIS, SIR),Newton's Law of cooling, Single compartment modelling, Bending of beam models.	
	SERIES SOLUTION AND SPECIALFUNCTIONS	**(07 Hours)**
	Regular point, Singular point, series solution of ODE of 2nd order with variable coefficient with special emphasis to differential equation of Legendre's and Bessel's for different cases of roots of indicial equations.	
	VECTOR SPACE AND SUBSPACES	**(07 Hours)**

	Fields, Vector spaces over a field, subspaces, Linear independence and dependence, coordinates, Bases and dimension,Gram-Schmidt orthonormalization, Orthonormal basis, Orthogonal projection..	
	BETA AND GAMMAFUNCTION	**(05 Hours)**
	Beta and Gamma function with their properties and duplications formula without proof.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials:**
1	Tutorial will be related to Differential Calculus.
2	Tutorial will be on Radius of curvature for Cartesian curve with application.
3	Tutorial will cover Ordinary differential equations.
4	Tutorial will be on examples of Higher order Ordinary differential equations.
5	Tutorial will be on examples of Application of Ordinary differential equations.
6	Tutorial will be on Series solution with ordinary point
7	Tutorial will be on Series solution with regular singular point
8	Tutorial will be on Vector space
9	Tutorial will be on Subspaces
10	Tutorial will be on Beta and Gamma Function

4.	**Books Recommended:**
1	Kreyszig E., “Advanced Engineering Mathematics”, 10th Ed., John Wiley, 2015.
2	Wylie C. R., “Advance Engineering Mathematics”, 6th Ed., McGraw-Hill, 1995.
3	James Stewart, “Calculus”, Thomson Asia, Singapore, 200
4	Simmons, G. F. Differential equations with applications and historical notes. CRC Press, 2016.
5	Kenneth Hoffman and Ray Kunze, “Linear Algebra”, 2nd Ed. PHI publication, 2009.

B. Tech. I (Electrical) Semester – II Mathematics-II MA114	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	Apply the concept of partial differentiation to engineering problems.
CO2	Evaluate the solution of partial differential equations of first order.
CO3	Evaluate the double and triple integrals.
CO4	Apply the concept of vector calculus to engineering problems.
CO5	Describe the convergence and divergence of infinite series.
CO6	Apply the concept of partial differentiation to engineering problems.

2.	Syllabus:	
	PARTIALDIFFERENTIATION	**(10 Hours)**
	Partial differentiation, Euler's theorem for homogeneous function, Modified Euler's theorem, Taylor's and Maclaurin's series for two variables. Tangent plane and Normal line, Error and Approximation, Jacobians with properties, Extreme values of function of two variables, Lagrange's methods of undetermined multipliers.	
	INTRODUCTION TO PARTIAL DIFFERENTIALEQUATION	**(08 Hours)**
	Introduction to Partial differential equation, Formation of partial differential Equation, Partial differential Equation of first order, Linear partial differential equation of first order (Pp + Qq=R) and method of obtaining its general solution, Non-linear partial differential equation of first order f(p, q)=0, f(z, p, q)=0, f(x, p)= g(y, q), z= px + qy + f(p, q).	
	DOUBLE AND TRIPLE INTEGRALS	**(10 Hours)**
	Reorientation of concepts of integrals and Double integrals, evaluation techniques, change of order of Integration, change of variable, Application of double integrals for evaluation of area and volume. Triple integrals, evaluation techniques, Application of triple integrals for evaluation of volume.	
	VECTOR CALCULUS	**(09 Hours)**
	Scalar and vector point function, differential operator, gradient, directional derivative, divergence, curl and Laplacian operator with their properties, Line integral, Surface Integral, Volume integral, Green's, Gauss and Stokes theorem (Only statement) & application.	
	INFINITE SERIES	**(08 Hours)**
	Introduction, Positive term series, Comparison test, Cauchy's root test, D'Alembert's test, Raabe's test, Logarithmic test, Integral test, Gauss's test, Series with arbitrary terms, Rearrangement of terms	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	Tutorials
1	Tutorial will be related to Partial Differentiation.
2	Tutorial will be on Extreme values of function of two variables
3	Tutorial will be on Partial differential Equation.
4	Tutorial will be on special type of Partial differential Equation.
5	Tutorial will be on Double Integral
6	Tutorial will be on will be on Triple Integral.
7	Tutorial will be on Vector Calculus
8	Tutorial will be on examples of vector calculus.
9	Tutorial will be on Green's, Gauss and Stokes theorem (Only statement) & application.
10	Tutorial will be on Infinite Series

4.	Books Recommended:
1.	Malik S.C., and Arora S., "Mathematical Analysis", 5th Ed., Wiley Eastern Ltd., New Age International Publishers, 2017.
2.	Raisinghania M. D., "Ordinary and Partial Differential Equations", 18th Ed., S. Chand Publication, 2016
3.	Kreyszig E., "Advanced Engineering Mathematics", 10th Ed., John Wiley, 2015.
4.	Wylie C. R., "Advance Engineering Mathematics", 6th Ed., McGraw-Hill, 1995. James Stewart, "Calculus", Thomson Asia, Singapore, 2003

B.Tech. I (ECE) Semester – I **Mathematics-I** **MA117**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**1**	**0**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	learn various methods of solving ordinary differential equations of first order and its importance in engineering problems
CO2	to develop mathematical models through ordinary differential equation of first order
CO3	describe the convergence and divergence of infinite series and analyze the Fourier integral and Fourier transform of a function
CO4	familiarize with special functions to evaluate some proper and improper integrals using beta and gamma functions
CO5	develop basic concept of the linear algebra to electronics engineering problems.

2.	**Syllabus**	
	ORDINARY DIFFERENTIAL EQUATION OF FIRST ORDER FIRST DEGREE AND FIRST ORDER HIGHER DEGREE	**(08 Hours)**
	Reorientation of differential equation first order first degree, Exact differential equation and Integrating factors, first order higher degree odes, solvable for p, y and x, Clairaut's equation.	
	APPLICATION OF DIFFERENTIAL EQUATION (MATHEMATICAL MODELLING)	**(08 Hours)**
	Modeling of Real world problems particularly Engineering System, Electrical network models (RL & RC circuit), spread of epidemic (SI, SIS, SIR), Newton's Law of cooling, Single compartment modelling.	
	INFINITE SERIES	**(08 Hours)**
	Introduction, Positive term series, Comparison test, Cauchy's root test, D'Alembert's test, Raabe's test, Logarithmic test, Integral test, Gauss's test, Series with arbitrary terms, Rearrangement of terms.	
	FOURIER SERIES	**(06 Hours)**
	Definition, Fourier Series with Arbitrary Period, In Particular Periodic Function With Period 2π. Fourier Series of Even and Odd Functions, Half Rang Fourier Series.	
	FOURIER INTEGRAL AND TRANSFORM	**(07 Hours)**
	Fourier Integral Theorem, Fourier Sine and Cosine Integral Complex Form Of Integral, Inversion Formula For Fourier Transforms, Fourier Transform of derivative of a Functions.	
	BETA AND GAMMA FUNCTION	**(04 Hours)**

	Beta and Gamma function with their properties and duplications formula without proof.	
	SYSTEM OF LINEAR ALGEBRIC EQUATION	**(04 Hours)**
	Linear systems, Elementary row and column transformation, rank of matrix, consistency of linear system of equations, Linear Independence and Dependence of vectors, Gauss Elimination method, Gauss-Jorden Method, Gauss-Jacobi Iteration Method.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Ordinary differential equation of first order -i
2	Ordinary differential equation of first order-ii
3	Application of differential equation
4	Infinite series-i
5	Infinite series-ii
6	Fourier series-i
7	Fourier series-ii
8	Fourier integral and transform-i
9	Fourier integral and transform-ii
10	Beta and gamma function-i
11	Beta and gamma function-ii
12	System of linear algebraic equation-i
13	System of linear algebraic equation-ii
14	System of linear algebraic equation-iii

4.	**Books Recommended**
1	Kreyszig E., "Advanced Engineering Mathematics", John Wiley & Sons, Singapore, Int. Student Ed. 2015.
2	James Stewart, "Calculus", Thomson Asia, Singapore, 2003.
3	O'Neel Peter, "Advanced Engg. Mathematics", Thompson, Singapore, Ind. Ed. 2002.
4	F. B. Hilderband, "Methods of Applied mathematics", PHI, New Delhi, 1968 .
5	Wiley C. R., "Advanced Engineering Mathematics", McGraw Hill Inc., New York Ed. 1993.
6	F. B. Hilderband, "Methods of Applied mathematics", PHI, New Delhi, 1968.
7	Bali and Iyengar. Engg. Mathematics, Laxmi Publications, New Delhi, 2004.

B.Tech. I (ECE) Semester – II Mathematics-II (CORE-1) MA116	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	learn various methods of solving higher order ordinary differentials and its importance to engineering problems
CO2	develop mathematical modelling through higher order differential equations
CO3	the basics and importance of Laplace transform including its applications to differential equations
CO4	explain the fundamental concepts of vector calculus and their role in modern mathematics and applied contexts.
CO5	learn to find and use eigenvalues and eigenvectors of a matrix and work with vector spaces and subspaces.

2.	Syllabus	
	ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER	**(09 HOURS)**
	Solution of homogenous equations higher order, complementary functions, Particular Integrals, Linear differential equation with variable coefficient, Cauchy's Euler and Legendre's equation with variable coefficient, Method of variation of parameters Regular point, Singular point, series solution of ODE of 2nd order with variable coefficient with special emphasis to differential equation of Legendre's and Bessel's for different cases of roots of indicial equations.	
	APPLICATION OF HIGHER ORDER ORDINARY DIFFERENTIAL EQUATION (MATHEMATICAL MODELLING)	**(05 HOURS)**
	Electrical network models (LCR circuit), Bending of beam models.	
	LAPLACE TRANSFORM	**(07 HOURS)**
	Laplace transform, Existence theorem, Laplace transform of derivatives and integrals, Inverse Laplace transform, Unit step functions, Dirac –delta functions , Laplace transform of periodic functions, Convolutions theorem, Application to solve simple linear and simultaneous differential equations.	
	VECTOR CALCULUS	**(07 HOURS)**
	Partial differentiation, Euler‟s theorem for homogeneous function, Modified Euler‟s theorem Scalar and vector point function, differential operator, gradient, directional derivative, divergence, curl and Laplacian operator with their properties, Line integral, Surface Integral, Volume integral, Green's, Gauss and Stokes theorem (Only statement) & application.	

	MATRICES	**(05 HOURS)**
	Properties of matrices, Non-singular Matrices, Reduced Row-Echelon form, Systems of linear equations, Solution of system of linear equations, LU Decomposition Method.	
	EIGENVALUES AND EIGENVECTORS	**(06 HOURS)**
	Eigen values and eigenvectors, Characteristic polynomials, Minimal polynomials, Diagonalizability, Triangularization, Rational canonical form, Jordon canonical form, Positive Define Matrices, Singular Value Decomposition.	
	VECTOR SPACE AND SUBSPACES	**(06 HOURS)**
	Fields, Vector spaces over a field, subspaces, Linear independence and dependence, coordinates, Bases and dimension, Gram-Schmidt orthonormalization, Orthonormal basis, Orthogonal projection.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Ordinary differential equations of higher order-i
2	Ordinary differential equations of higher order-ii
3	Ordinary differential equations of higher order-iii
4	Application of higher order ordinary differential equation
5	Laplace transform-i
6	Laplace transform-ii
7	Vector calculus-i
8	Vector calculus-ii
9	Matrices-i
10	Matrices-ii
11	Eigenvalues and eigenvectors-i
12	Eigenvalues and eigenvectors-ii
13	Vector space and subspaces-i
14	Vector space and subspaces-ii

4.	**Books Recommended**
1	Malik S.C., and Arora S., “Mathematical Analysis”, 5th Ed., Wiley Eastern Ltd., New Age International Publishers, 2017.
2	Kreyszig E., “Advanced Engineering Mathematics”, 10th Ed., John Wiley, 2015.
3	Wiely C. R., “Advance Engineering Mathematics”, 6th Ed., McGraw-Hill, 1995.
4	Gilbert Strang, “Introduction to Linear Algebra”, 5th Ed., Wellesley-Cambridge Press, 2016.
5	Kenneth Hoffman and Ray Kunze, “Linear Algebra”, 2nd Ed. PHI publication, 2009.

Department of Civil Engineering

B.Tech. I (Civil) Semester – I Mathematics-I MA109	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	acquire the knowledge of linear algebra to solve problem of engineering
CO2	use calculus as a tool to solve the engineering problem
CO3	apply the knowledge of curve tracing to solve engineering problem
CO4	apply double and triple integrals for evaluation of area and volume
CO5	analyze the engineering industrial problems using the concept of probability & statistics

2.	Syllabus:	
	SYSTEM OF LINEAR ALGEBRIC EQUATIONS	**(05 Hours)**
	Linear systems, Elementary row and column transformation, rank of matrix, consistency of linear system of equations, Linear Independence and Dependence of vectors, Gauss Elimination method, Gauss-Jorden Method, Gauss-Jacobi Iteration Method.	
	DIFFERENTIAL CALCULUS	**(10 Hours)**
	Differentiation of Hyperbolic and Inverse Hyperbolic functions. Successive Differentiation, standard forms, Leibnitz's theorem and applications, Power series, Expansion of functions, Taylor's and Maclaurin's series. Curvature, Radius of curvature for Cartesian curve with application.	
	PARTIAL DIFFERENTIATION	**(09 Hours)**
	Partial differentiation, Euler's theorem for homogeneous function, Modified Euler's theorem, Taylor's and Maclaurin's series for two variables. Tangent plane and Normal line, Error and Approximation, Jacobians with properties, Extreme values of function of two variables, Lagrange's methods of undetermined multipliers.	
	CURVE TRACING	**(04 Hours)**
	Cartesian, polar and parametric form of standard curves.	
	DOUBLE AND TRIPLE INTEGRALS	**(07 Hours)**
	Reorientation of concepts of integrals, Double integrals and triple integrals, evaluation techniques, change of order of integration, change of variable, Evaluation of area and volume.	
	STATISTICS AND PROBABILITY	**(10 Hours)**
	Correlation between two variables, application of correlation, evaluation of coefficients of correlation, Rank correlation, Regression, Frequency distribution, Binomial, Poisson and Normal distributions, application to Civil Engineering problems. Introduction to hypothesis testing, Test of significance, Chi-square test, t- test, application of the t-test, F-distribution	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	Tutorials
1.	Tutorial will on algebraic system of equation and rank theory
2.	Tutorial will be on Gauss Elimination method, Gauss-Jorden Method, Gauss-Jacobi Iteration Method.
3.	Tutorial will be on differential calculus
4.	Tutorial will be on Curvature, Radius of curvature for Cartesian curve with application..
5.	Tutorial will be on partial differentiation.
6.	Tutorial will be on curve tracing.
7.	Tutorial will be on double integral.
8.	Tutorial will be on triple integral.
9.	Tutorial will be on basics of statistics and correlation.
10.	Tutorial will be on statistical test.

4.	**Books Recommended:**
1	Kreyszig E., Advanced Engineering Mathematics, 10th Ed., John Wiley, 2015.
2	James Steward De, Calculus, Thomson Asia, Singapore, 2003.
3	O'Neel Peter., Advanced Engineering Mathematics, Thompson, Singapore, Ind. Ed. 2002.
4	Greenberg M D, Advanced Engineering Mathematics, Pearson, Singapore, 2007.
5	Wiley C R, Advanced Engineering Mathematics, McGraw Hill Inc., New York,1993.

B.Tech. I (Civil) Semester – II Mathematics-II MA108	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course the students will be able to:
CO1	apply ordinary differential equations in engineering problem solving
CO2	develop the Fourier series of the periodic functions
CO3	derive Fourier integral from Fourier series and comprehend the concept of integral transforms with their applications
CO4	apply Laplace transforms in engineering problems
CO5	analyse the partial differential equations of second order

2.	Syllabus:	
	ORDINARY DIFFERENTIAL EQUATIONS AND APPLICATIONS	**(10 Hours)**
	Reorientation of differential equation first order first degree, exact differential equation and Integrating factors, solvable for p, y and x, Solution of homogenous equations higher order, complementary functions, Particular Integrals, Linear differential equation with variable coefficient, Cauchy's Euler and Legendre's equation with variable coefficient, Method of variation of parameters. Application of ODE in Civil Engineering problems	
	FOURIER SERIES	**(06 Hours)**
	Definition, Fourier series with arbitrary period, in particular periodic function with period 2π. Fourier series of even and odd function, Half range Fourier series.	
	FOURIER INTEGRAL AND FOURIER TRANSFORMS	**(07 Hours)**
	Fourier Integral theorem, Fourier sine and cosine integral complex form of integral, Inversion formula for Fourier transforms, Fourier transforms of the derivative of a function.	
	LAPLACE TRANSFORMS	**(08 Hours)**
	Introduction, Definition, Existence conditions, basic properties, Inverse Laplace transform and properties, Convolution Theorem and properties, Applications of Laplace transforms.	
	PARTIAL DIFFERENTIAL EQUATIONS	**(14 Hours)**
	Formation of partial differential Equation, Partial differential Equation of first order, Linear partial differential equation of first order (Pp + Qq=R) and method of obtaining its general solution, Non-linear partial differential equation of first order f(p, q)=0, f(z, p, q)=0, f(x, p)= g(y, q), z= px + qy + f(p, q). Second order PDE, Heat, wave and Laplace equation, one dimensional with standard boundary conditions, solution by separation of variable method using Fourier series, Solution by separation of variables and transformation techniques.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Tutorial will cover Ordinary differential equations.
2	Tutorial will be on examples of Higher order Ordinary differential equations.
3	Tutorial will be on examples of Application of Ordinary differential equations.
4	Tutorial will be on examples Fourier series.
5	Tutorial will be on examples Half range Fourier series.
6	Tutorial will be on Fourier Integral.
7	Tutorial will be on Fourier Transform.
8	Tutorial will be on Laplace Transform.
9	Tutorial will be on Partial differential Equation.
10	Tutorial will be on special type of Partial differential Equation.

4.	**Books Recommended:**
1	Kreyszig E., Advanced Engineering Mathematics, 10th Ed., John Wiley, 2015.
2	James Stewart, Calculus, Thomson Asia, Singapore, 2003.
3	O'Neel Peter., Advanced Engineering Mathematics, Thompson, Singapore, Ind. Ed. 2002.
4	Greenberg M D, Advanced Engineering Mathematics, Pearson, Singapore, 2007.
5	Wiley C R, Advanced Engineering Mathematics, McGraw Hill Inc., New York,1993.

B.Tech. I (DoME) Semester – I ENGINEERING MATHEMATICS MA119	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, students will be able to
CO1	Solve a system of linear algebraic equations
CO2	Expand the periodic functions in the form of Fourier series
CO3	Obtain higher order differential equations
CO4	Explain the use of complex variable for conformal transformation
CO5	Demonstrate probability and statistical analysis to Engineering applications
CO6	Apply numerical methods to solve partial differential equations

2.	SYLLABUS	
	LINEAR ALGEBRA	**(06 Hours)**
	Matrix algebra, systems of linear equations, eigen values and eigen vectors	
	CALCULUS	**(08 Hours)**
	Functions of single variable, limit, continuity and differentiability, mean value theorems, indeterminate forms; evaluation of definite and improper integrals; double and triple integrals; partial derivatives, total derivative, Taylor series (in one and two variables), maxima and minima, Fourier series; gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, applications of Gauss, Stokes and Green's theorems	
	DIFFERENTIAL EQUATIONS	**(08Hours)**
	First order equations (linear and nonlinear); higher order linear differential equations with constant coefficients; Euler-Cauchy equation; initial and boundary value problems; Laplace transforms; solutions of heat, wave and Laplace's equations.	
	COMPLEX VARIABLES	**(10 Hours)**
	Analytic functions; Cauchy-Riemann equations; Cauchy's integral theorem and integral formula; Taylor and Laurent series	
	PROBABILITY AND STATISTICS	**(05 Hours)**
	Definitions of probability, sampling theorems, conditional probability; mean, median, mode and standard deviation; random variables, binomial, Poisson and normal distributions	
	NUMERICAL METHODS	**(08 Hours)**
	Numerical solutions of linear and non-linear algebraic equations; integration by trapezoidal and Simpson's rules; single and multi-step methods for differential equations	
		(Total Contact Time:45 Hours)

3.	**Tutorials**
	Numerical based on the respective units

4.	**Books Recommended**
1	Kreyszing E., “Advanced Engineering Mathematics”, John Wiley & Sons, Singapore, Int. Student Ed. 2015.
2	James Steward De, “Calculus”, Thomson Asia, Singapore, 2003
3	O’Neel Peter., “Advanced Engg. Mathematics”, Thompson, Singapore, Ind. Ed. 2002.
4	Wiley C. R., “Advanced Engineering Mathematics”, McGraw Hill Inc., New York Ed. 1993
5	Michael D. Greenber, “Advance Engineering Mathematics”, Pearson (Singapore) Indian Edition, 2007

Department of Physics

First Year: Five years M.Sc. Integrated in Physics

M.Sc.-I (Physics) Semester – I **Mathematics for Physical Sciences -I** **MA 123**	**Scheme**	**L**	**T**	**P**	**Credit**
		3	**1**	**0**	**04**

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Explain the basic concept and solutions of ordinary differential equation.
CO2	Formulate Mathematical Modelling of real world problems.
CO3	Find series solution of ODE at regular and singular points
CO4	Solve linear and Non-linear PDEs
CO5	Analyze the concept of Vector calculus and System of Linear Algebraic equations

2.	**Syllabus**	
	ORDINARY DIFFERENTIAL EQUATION	**(10 Hours)**
	Reorientation of differential equation first order first degree, exact differential equation and Integrating factors, first order higher degree odes, solvable for p, y and x, Solution of homogenous equations higher order, complementary functions, Particular Integrals, Linear differential equation with variable coefficient, Cauchy's Euler and Legendre's equation with variable coefficient, Method of variation of parameters.	
	APPLICATION OF DIFFERENTIAL EQUATION (MATHEMATICAL MODELLING)	**(07 HOURS)**
	Modeling of Real world problems particularly Engineering System, Electrical network models (LCR), spread of epidemic (SI, SIS, SIR), Newton's Law of cooling. Single compartment modelling, Bending of beam models.	
	SERIES SOLUTION AND SPECIAL FUNCTIONS	**(07 HOURS)**
	Regular point, Singular point, series solution of ODE of 2nd order with variable coefficient with special emphasis to differential equation of Legendre's and Bessel's for different cases of roots of indicial equations.	
	INRODUCTION TO PARTIAL DIFFERENTIAL EQUATION	**(08 HOURS)**
	Introduction to Partial differential equation, Formation of partial differential Equation, Partial differential Equation of first order, Linear partial differential equation of first order (Pp+Qq-R) and method of obtaining its general solution, Non-linear partial differential equation of first order f(p, q)=0, f(z.,p.,q)=0, f(x, p)=g(y,q), z=px + qy +f(p,q).	

	VECTOR CALCULUS	**(08 HOURS)**
	Scalar and vector point function, differential operator, gradient, directional derivative, divergence, curl and Laplacian operator with their properties, Line integral, Surface Integral, Volume integral, Green's, Gauss and Stokes theorem (Only statement) & application.	
	SYSTEM OF LINEAR ALGEBRIC EQUATION	**(05 HOURS)**
	Linear systems, Elementary row and column transformation, rank of matrix, consistency of linear system of equations, Linear Independence and Dependence of vectors, Gauss Elimination method, Gauss-Jorden Method, Gauss-Jacobi Iteration Method	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours= 60 Hours)	

3.	**Tutorials**
1	Tutorial will be related to Ordinary differential equations.
2	Tutorial will be on ordinary differential equations with variable co-efficient.
3	Tutorial will be on different examples of ordinary differential equations.
4	Tutorial will be on Mathematical modelling.
5	Tutorial will be on Series solution and other special cases of it.
6	Tutorial will cover partial differential equations.
7	Tutorial will be on examples of partial differential equations.
8	Tutorial will be on Vector Calculus.
9	Tutorial will be on applications of Area, Volume.
10	Tutorial will be on system of linear algebraic equations

4	**Books Recommended:**
1	Kreyszig E., "Advanced Engineering Mathematics", John Wiley & Sons, Singapore, Int Student
2	James Stewart , "Calculus", Thomson Asia, Singapore, 2003.
3	O'Neel Peter., "Advanced Engg. Mathematics", Thompson, Singapore, Ind. Ed. 2002.
4	HilderbandF. B., "Methods of Applied mathematics", PHI, New Delhi, 1968
5	Wiley C. R., "Advanced Engineering Mathematics", McGraw Hill Inc., New York Ed. 1993,
	Reference Book
7	Ramana B. V., "Higher Engg. Mathematics", The MaGraw-Hill Inc., New Delhi, 2007.
8	Srimanta Pal, Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, New Delhi,
9	Mary L. Boas, Mathematical Methods in the Physical Sciences, John Wiley & Sons, Ed.2005.
10	J. N. Kapur, Mathematical Models in Biology and Medicine. East west Press, New Delhi 1985.

M.Sc.-I (Physics) Semester – II Mathematics for Physical Sciences -II MA 118	Scheme	L	T	P	Credit
		3	1	0	04

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Explain about infinite series
CO2	Analyze the Fourier series with different periods
CO3	Find the Fourier transform of functions
CO4	Analyze Complex Variables
CO5	Apply sampling theory and estimation

2.	**Syllabus**	
	INFINITE SERIES	**(05 Hours)**
	Introduction, Positive term series, Comparison test, Cauchy's root test, D'Alembert's test, Raabe's test, Logarithmic test, Integral test, Gauss's test,	
	FOURIER SERIES	**(07 HOURS)**
	Definition, Fourier series with arbitrary period, in particular periodic function with period 2π. Fourier series of even and odd function, Half range Fourier series	
	FOURIER TRANSFORM AND FOURIER TRANSFORM OF AN INTEGRAL	**(07 HOURS)**
	Fourier transform and its operational properties, Fourier Integral theorem, Fourier Cosine and solution, transform of derivatives, Inversion formula for Fourier transforms.	
	COMPLEX VARIABLES	**(06 Hours)**
	Basic mathematical concept, Analytic function, Cauchy – Riemann equations, Harmonic functions, its applications, Linear transformation of complex domain, bilinear transformations, conformal mapping and its application, complex integration over closed contour.	
	BASIC OF STATISTICS AND PROBABILITY DISTRIBUTION	**(06Hours)**
	Reorientation of random experiments, events, probability and its distributions of Binomial &Poisson‟s, their properties and Normal distribution, jointly distributed random variables, expected values, function of random variable moments, moment generating functions.	
	SAMPLING THEORY AND ESTIMATION	**(07 Hours)**
	Some basics of sampling, statistical inference, Random Samples, Sampling distribution, Sample mean, variance and other statistics, point estimate and interval estimate confidence of interval, maximum likehood estimate.	

	TESTING OF HYPOTHESIS	**(07 Hours)**
	Sampling and Test of significance, Statistical hypothesis and significance, Type I and Type II errors, Test of significance. Level of Significance, single tail and two tail tests hypothesis Chi-square ($\chi 2$) test, student‟s t Test of significance of the mean of a random sample,t-test for difference of means of two small samples, Snedecor‟s variance ratio test or F-test and tis applications.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours= 60 Hours)	

3.	**Tutorials**
1	Tutorial one will be related to infinite series.
2	Tutorial two will be on different test of infinite series for its convergence.
3	Tutorial three, will be on Fourier series.
4	Tutorial four will be on Fourier transform.
5	Tutorial five will cover examples of Fourier integral theorem.
6	Tutorial six will be on Complex variables.
7	Tutorial seven will cover basic of statistics.
8	Tutorial eight will be based on Probability Distribution.
9	Tutorial nine will be based on Sampling theory.
10	Tutorial ten will be on Estimation: different test and its applications.

4.	**Books Recommended:**
1	Kreyszig E., „Advanced Engineering Mathematics‟, John Wiley & Sons, Singapore, Int. Student Ed. 1995
2	Wiley C. R., „Advanced Engineering Mathema tics‟, McGraw Hill Inc., New York Ed. 1993.
3	O‟Neil Peter., „Advanced Engg. Mathematics‟, Thompson, Singapore, Ind. Ed. 2002.
4	Greenbar Michael D., „Advanced Engg. Mathematics‟, Pearson, Singapore, Ind. Ed. 2007.
5	Ramana D. V., „Higher Engg. Mathematics‟, The MaGraw-Hill Inc., New Delhi, 2007

Department of Chemistry
First Year: Five years M.Sc. Integrated in Chemistry

M.Sc.– I (Chemistry), Semester – I Mathematics for Chemistry MA121	Scheme	L	T	P	Credit
		3	1	0	04

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Solve successive differentiations with its applications to different series expansions.
CO2	Apply partial differentiation to find series expansion with error approximations, extremals and jacobians.
CO3	Trace curves in Cartesian, polar, and parametric forms.
CO4	Solve first-order ordinary differential equations with its applications to real world problems.
CO5	Analyze the Linear systems of algebraic equation with different approach.

2.	Syllabus	
	DIFFERENTIAL CALCULUS	**(10 Hours)**
	Differentiation of Hyperbolic and Inverse Hyperbolic functions. Successive Differentiation, standard forms, Leibnitz's theorem and applications, Power series, Expansion of functions, Taylor's and Maclaurin's series. Curvature, Radius of curvature for Cartesian curve with application.	
	PARTIAL DIFFERENTIATION	**(10 HOURS)**
	Partial differentiation, Euler's theorem for homogeneous function, Modified Euler's theorem, Taylor's and Maclaurin's series for two variables. Tangent plane and Normal line, Error and Approximation, Jacobians with properties, Extreme values of function of two variables, Lagrange's methods of undetermined multipliers.	
	CURVE TRACING	**(05 HOURS)**
	Cartesian, polar and parametric for of standard curves.	
	ORDINARY DIFFERENTIAL EQUATION	**(08 HOURS)**
	Reorientation of the differential equation first order first degree, exact differential equation and Integrating factors, Solution of homogenous equations higher order, complementary functions, Particular Integrals, Linear differential equation with variable coefficient	
	APPLICATION OF DIFFERENTIAL EQUATION (MATHEMATICAL MODELLING)	**(07 HOURS)**
	Modelling of Real-world problems, particularly ChemicalSystems, the spread of epidemic (SI, SIS, SIR), Newton's Law of cooling, Single compartment modelling, Bending of beam models.	
	SYSTEM OF LINEAR ALGEBRAIC EQUATION	**(05 HOURS)**

	Linear systems, Elementary row, and column transformation, the rank of a matrix, consistency of the linear system of equations, Linear Independence and Dependence of vectors, Gauss Elimination method, Gauss-Jorden Method, Gauss-Jacobi Iteration Method.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Differential calculus-I
2	Differential calculus-II
3	Differential calculus-III
4	Partial differentiation-I
5	Partial differentiation-II
6	Curve tracing-I
7	Curve tracing-II
8	Ordinary differential equation-I
9	Ordinary differential equation-II
10	Ordinary differential equation-III
11	Application of differential equation-I
12	Application of differential equation-II
13	System of linear algebraic equation-I
14	System of linear algebraic equation-II

4.	**Books Recommended**
1	J. Stewart, "Calculus," Thomson Asia, Singapore, 1 January 2012.
2	P. O'Neil, "Advanced Engineering Mathematics," Thompson, Singapore, Ind. Ed. 2002.
3	Kreyszig E., "Advanced Engineering Mathematics," John Wiley & Sons, Singapore, Int. Student Ed. 2015.
4	Wiley C. R., “Advanced Engineering Mathematics”, McGraw Hill Inc., New York Ed. 1993.
5	Bali and Iyengar. Engg. Mathematics, Laxmi Publications, New Delhi, 2004.