B. TECH. FIRST YEAR COURSES

(Common to all B. Tech. Courses except B. Tech., Biotechnology and B. Tech. Agricultural Engineering)
(Effective from the Session: 2018-19)

Subject Code	KAS 103					
Category	Basic Science Course					
Subject Name	Engineering Mathematics-I					
Scheme and Credits	**L-T-P**	**Theory Marks**	**Sessional**		**Total**	**Credit**
			Test	**Assig/Att.**		
	3—1—0	100	30	20	150	4
Pre- requisites (if any)	Knowledge of Intermediate Mathematics of UP Board or equivalent Board.					

Course Objectives:

The objective of this course is to familiarize the graduate engineers with techniques in calculus, multivariate analysis, vector calculus and linear algebra. It aims to equip the students with standard concepts and tools from intermediate to advanced level that will enable them to tackle more advanced level of mathematics and applications that they would find useful in their disciplines.

The students will learn:

- To apply the knowledge of differential calculus in the field of engineering.
- To deal with functions of several variables that are essential in optimizing the results of real life problems.
- Multiple integral tools to deal with engineering problems involving centre of gravity, volume etc.
- To deal with vector calculus that is required in different branches of Engineering to graduate engineers.
- The essential tools of matrices and linear algebra, eigen values and diagonalization in a comprehensive manner are required.

Mathematics-I

All India Council for Technical Education Mathematics Course (Common)

Mathematics - 3L 1T 0P

1. **Module 1: Matrices (8 hours)**

   Types of Matrices: Symmetric, Skew-symmetric and Orthogonal Matrices; Complex Matrices, Inverse and Rank of matrix using elementary transformations, Rank-Nullity theorem; System of linear equations, Characteristic equation, Cayley-Hamilton Theorem and its application, Eigen values and eigenvectors; Diagonalisation of a Matrix,

2. **Module 2: Differential Calculus- I (10 hours)**

   Introduction to limits, continuity and differentiability, Rolle's Theorem, Lagrange's Mean value theorem and Cauchy mean value theorem, Successive Differentiation (n^{th} order derivatives), Leibnitz theorem and its application, Envelope, Involutes and Evolutes, Curve tracing: Cartesian and Polar co-ordinates

3. **Module 3: Differential Calculus-II (8 hours)**

   Partial derivatives, Total derivative, Euler's Theorem for homogeneous functions, Taylor and Maclaurin's theorems for a function of one and two variables, Maxima and Minima of functions of several variables, Lagrange Method of Multipliers, Jacobians, Approximation of errors.

4. **Module 4: Multivariable Calculus-I (8 hours)**

   Multiple integration: Double integral, Triple integral, Change of order of integration, Change of variables, **Application:** Areas and volumes, Center of mass and center of gravity (Constant and variable densities),

5. **Module 5: Vector Calculus (8 hours)**

   Vector differentiation: Gradient, Curl and Divergence and their Physical interpretation, Directional derivatives, Tangent and Normal planes.
   Vector Integration: Line integral, Surface integral, Volume integral, Gauss's Divergence theorem, Green's theorem, Stoke's theorem (without proof) and their applications.

Text Books:-

1. B. V. Ramana, Higher Engineering Mathematics, Tata Mc Graw-Hill Publishing Company Ltd., 2008.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. R K. Jain & S R K. Iyenger , Advance Engineering Mathematics, Narosa Publishing House 2002

Reference Books:-

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.

3. Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
4. D. Poole, Linear Algebra : A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
6. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, Tata Mc-Graw-Hill; Sixth Edition.
7. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd

COURSE OUTCOMES

	Course Outcome (CO)	Bloom's Knowledge Level (KL)
At the end of this course, the students will be able to:		
CO 1	Remember the concept of matrices and apply for solving linear simultaneous equations.	K_1 & K_3
CO 2	Understand the concept of limit , continuity and differentiability and apply in the study of Rolle,s , Lagrange,s and Cauchy mean value theorem and Leibnitz theorems .	K_2 & K_3
CO 3	Identify the application of partial differentiation and apply for evaluating maxima, minima, series and Jacobians.	K_3 & K_5
CO 4	Illustrate the working methods of multiple integral and apply for finding area, volume, centre of mass and centre of gravity.	K_2 & K_3
CO 5	Remember the concept of vector and apply for directional derivatives, tangent and normal planes. Also evaluate line, surface and volume integrals.	K_2 & K_5

K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5 – Evaluate, K_6 – Create

Evaluation methodology to be followed:

The evaluation and assessment plan consists of the following components:

a. Class attendance and participation in class discussions etc.
b. Quiz.
c. Tutorials and assignments.
d. Sessional examination.
e. Final examination.

Award of Internal/External Marks:

Assessment procedure will be as follows:

1. These will be comprehensive examinations held on-campus (Sessionals).
2. Quiz.
   a. Quiz will be of type multiple choice, fill-in-the-blanks or match the columns.
   b. Quiz will be held periodically.
3. Tutorials and assignments
   a. The assignments/home-work may be of multiple choice type or comprehensive type at least one assignment from each Module/Unit.
   b. The grades and detailed solutions of assignments (of both types) will be accessible after the submission deadline.
4. Final examinations.
   These will be comprehensive external examinations held on-campus or off campus (External examination) on dates fixed by the Dr. APJ Abdul Kalam Technical University, Lucknow.

(Common to all B. Tech. Courses except B. Tech., Biotechnology and B. Tech. Agricultural Engineering)
(Effective from the Session: 2018-19)

Subject Code	KAS 203					
Category	Basic Science Course					
Subject Name	Engineering Mathematics-II					
Scheme and Credits	**L-T-P**	**Theory Marks**	**Sessional**		**Total**	**Credit**
			Test	**Assig/Att.**		
	3—1—0	100	30	20	150	4
Pre-requisites (if any)	Knowledge of Intermediate Mathematics of UP Board or Equivalent Board as well as KAS 103.					

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in sequences, multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines. The students will learn:

- The effective mathematical tools for the solutions of differential equations that model physical processes
- To apply integral calculus in various field of engineering. Apart from some other applications students will have a basic understanding of Beta and Gamma functions.
- The tool of Fourier series for learning advanced Engineering Mathematics..
- The tools of differentiation of functions of a complex variables that are used in various techniques dealing with engineering problems.
- The tools of integration of functions of a complex variables that are used in various techniques dealing with engineering problems.

Mathematics-II

1. **Module 1: Ordinary Differential Equation of Higher Order (10 hours)**

   Linear differential equation of nth order with constant coefficients, Simultaneous linear differential equations, Second order linear differential equations with variable coefficients, Solution by changing independent variable, Reduction of order, Normal form, Method of variation of parameters, Cauchy-Euler equation, Series solutions (Frobenius Method).

2. **Module 2: Multivariable Calculus-II (8 hours)**

   Improper integrals, Beta & Gama function and their properties, Dirichlet's integral and its applications, Application of definite integrals to evaluate surface areas and volume of revolutions.

3. **Module 3: Sequences and Series (8 hours)**

Definition of Sequence and series with examples, Convergence of sequence and series, Tests for convergence of series, (Ratio test, D' Alembert's test, Raabe's test). Fourier series, Half range Fourier sine and cosine series.

4. **Module 4: Complex Variable – Differentiation (8 hours)**

Limit, Continuity and differentiability, Functions of complex variable, Analytic functions, Cauchy- Riemann equations (Cartesian and Polar form), Harmonic function, Method to find Analytic functions, Conformal mapping, Mobius transformation and their properties

5. **Module 5: Complex Variable –Integration (8 hours)**

Complex integrals, Contour integrals, Cauchy- Goursat theorem, Cauchy integral formula, Taylor's series, Laurent's series, Liouvilles's theorem, Singularities, Classification of Singularities, zeros of analytic functions, Residues, Methods of finding residues, Cauchy Residue theorem, Evaluation of real integrals of the type $\int_0^{2\pi} f(\cos\theta, \sin\theta)\, d\theta$ and $\int_{-\infty}^{\infty} f(x)\, dx$.

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4. G.B Thomas, R L Finney, Calculus and Analytical Geometry, Ninth Edition Pearson, 2002.
5. James Ward Brown and Ruel V Churchill, Fourier Series and Boundary Value Problems, 8th Edition-Tata McGraw-Hill
6. D. Poole , Linear Algebra : A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
7. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
8. Charles E Roberts Jr, Ordinary Diffrential Equations, Application, Model and Computing, CRC Press T&F Group.
9. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, 6th Edition, Tata McGraw-Hill.
10. James Ward Brown and Ruel V Churchill, Complex Variable and Applications, 8th Edition, Tata McGraw-Hill.
11. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd.

COURSE OUTCOMES

	Course Outcome (CO)	Bloom's Knowledge Level (KL)
At the end of this course, the students will be able to:		
CO 1	Understand the concept of differentiation and apply for solving differential equations.	K_2 & K_3
CO 2	Remember the concept of definite integral and apply for evaluating surface areas and volumes.	K_1, K_3 & K_5
CO 3	Understand the concept of convergence of sequence and series. Also evaluate Fourier series	K_2 & K_5
CO 4	Illustrate the working methods of complex functions and apply for finding analytic functions.	K_3
CO 5	Apply the complex functions for finding Taylor's series, Laurent's series and evaluation of definite integrals.	K_2 & K_5

K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5 – Evaluate, K_6 – Create

Evaluation methodology to be followed:

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