

	<b>Program</b>	B. Tech Computer Science and Engineering				<b>Program Code</b>	24BTHCSE	
	<b>Course</b>	Linear Algebra and Calculus				<b>Course Code</b>	24BTPHY/ELY102	
	<b>Semester</b>	I	<b>Credits</b>	4	<b>Theory</b> 3	<b>Practical</b> 2	<b>Total Hours</b>	60
<b>Course Objectives:</b>								
	<p>The main objective of the course <b>Linear Algebra and Calculus</b> is to enable the students to apply the knowledge of Mathematics in various engineering fields by making them to learn the following:</p> <ol style="list-style-type: none"> <li>1) To develop the knowledge of linear algebra and to solve problems on solution of system of linear equations, Eigen values and Eigen vectors.</li> <li>2) To derive the <math>n^{\text{th}}</math> derivative of standard functions and find the angle between radius vector and tangent of polar curves.</li> <li>3) Analyze the engineering problems on Partial derivatives and Jacobians.</li> <li>4) Apply the knowledge of integration to solve the problems on reduction formulae and multiple integrals.</li> <li>5) To solve the first order and higher order differential equations.</li> </ol>							
	<b>GENERAL INSTRUCTIONS FOR TEACHING-LEARNING PROCESS:</b>							
	<ol style="list-style-type: none"> <li>1) In addition to the traditional lecture method, different types of innovative teaching methods can be adopted so that students will develop theoretical and applied mathematical skills.</li> <li>2) To support and guide the students for self-study.</li> <li>3) To state the need for mathematics with engineering studies and provide real-life examples.</li> <li>4) To encourage the students for group learning and to improve their creative and analytical skills.</li> <li>5) Responsible for assigning homework, grading assignments and quizzes.</li> <li>6) Get familiarize with modern mathematical tool <b>PYTHON</b></li> </ol>							
<b>Module</b>	<b>Topics</b>						<b>Hours</b>	
I	<b>Linear Algebra</b>						9	
	Rank of a matrix by elementary transformations- Solution of system of linear equations using Gauss elimination method- Gauss Jordan method and Gauss seidel method- Problems							
	Eigen values and Eigen vectors- Rayleigh's power method to find the largest Eigen value and the corresponding Eigen vector- Problems.							
II	<b>Differential Calculus - I</b>						9	
	Determination of $n^{\text{th}}$ order derivatives of standard functions- Leibnitz's theorem (without proof)- Problems.							
	Polar curves- Angle between the radius vector and tangent- Angle between two polar curves- Pedal equation of polar curves- Problems.							
III	<b>Partial Differentiation - I</b>						9	
	Partial derivatives- Definition and simple problems on direct and indirect partial derivatives- Euler's theorem (without proof)- Total derivative- Partial differentiation of composite functions- Problems.							
	Definition and evaluation of Jacobians – Problems.							

IV	<b>Integral Calculus - I</b>	9
	Reduction formulae for the integrals of $\sin^n x$ , $\cos^n x$ , and $\sin^m x * \cos^n x$ (where m and n are positive integers) and evaluation of these integrals with standard limits (0 to $\pi/2$ ) and problems.	
	Multiple integrals- Double integrals and triple integrals - Problems.	
V	<b>Differential Equations</b>	9
	Solution of first order and first-degree differential equations- Linear differential equation- Bernoulli's differential equation- Exact differential equations. Higher order differential equation- Rules to find the complementary function and particular integrals- Solutions of homogeneous and non-homogeneous differential equations - Problems.	
<b>COURSE OUTCOMES:</b>		
<b>At the end of Course, Students will be able to</b>		
<b>CO1:</b> Use matrices techniques for solving the system of linear equations in the different areas of Linear Algebra.		
<b>CO2:</b> Solve the $n^{\text{th}}$ order derivatives and solve the problems related to polar curves.		
<b>CO3:</b> Use partial derivatives and to calculate the rate of change of multivariate functions.		
<b>CO4:</b> Solve the problems on reduction formulae, double and triple integrals.		
<b>CO5:</b> Recognize and solve first and higher order ordinary differential equations.		
<b>Assessment Details (both CA and ET)</b>		
The weightage of Continuous Assessment (CA) is 50% and for End Term Examination (ET) is 50%.		
<b>TEXT BOOKS:</b>		
1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 45 <sup>th</sup> edition, 2020.		
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley, 2013.		
3. Dr. D. S. C, "Engineering Mathematics-Part I", Prism Books Pvt. Ltd., 5 <sup>th</sup> edition, 2006.		
4. Dr. K. S. C., "Engineering Mathematics-I", Sudha Publications, latest edition, 2017.		
<b>REFERENCE BOOKS:</b>		
1) B. V. Ramana, "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.		
2) N. P. Bali and Manish Goyal, "A textbook of Engineering Mathematics", Laxmi Publications, Latest edition.		
3) H. K. Dass and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand Publishing, 1 <sup>st</sup> edition, 2011.		
4) David C Lay, "Linear Algebra and its Applications", Pearson Publishers, 4 <sup>th</sup> edition, 2018.		
5) Srimanta Pal & Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, 3 <sup>rd</sup> edition, 2016.		
6) Gupta C. B, Sing S. R and Mukesh Kumar, "Engineering Mathematics for Semester I and II", Mc-Graw Hill Education (India) Pvt. Ltd, 2015.		
7) Gareth Williams, "Linear Algebra with Applications", Jones Bartlett Publishers Inc., 6 <sup>th</sup> edition, 2017.		

**List of Laboratory programs (2 hours/week per batch/ batch strength 30)**

**8 lab sessions + 1 repetition class + 1 Lab Assessment**

**Software:** Python programming

**LIST OF PROGRAMS:**

Lab 1: Find the rank of a matrix and solution of linear equations by Gauss Seidel method.

Lab 2: Compute Eigen values and Eigen vectors, and to find the dominant Eigen values and corresponding Eigen vector by Rayleigh's power method.

Lab 3: 2-D plots of cartesian and polar curves.

Lab 4: Finding angle between two polar curves.

Lab 5: Find the partial derivatives and Jacobians.

Lab 6: Evaluation of improper integrals.

Lab 7: Solution of first order linear differential equation and exact differential equation

Lab 8: Solution of second-order differential equation.