SCHEME OF COURSE WORK

Course Details:

Course Title	**Calculus and Linear Algebra**		
Course Code	**19BM1101**	**L T P C**	**3 1 0 4**
Program:	**B.Tech.**		
Specialization:	**Computer Science Engineering**		
Semester	**I Semester**		
Prerequisites	• Basic formulae of differentiation, product rule, and quotient rule. • Basic Integration formulae, integration by parts, definite integrals and properties • solve a linear system of equations analytically and compute eigen values and eigen vectors of a square matrix		
Courses to which it is a prerequisite	**: For all Engineering Courses**		

PROGRAM OUTCOMES:

1. Graduates will be able to apply the knowledge of mathematics, science, engineering fundamentals and principles of Computer Science & Engineering to solve complex problems in different domains.

2. Graduates can identify, formulate, study contemporary domain literature and analyze real life problems and make effective conclusions using the basic principles of science and engineering.

3. Graduates will be in a position to design solutions for Engineering problems requiring in depth knowledge of Computer Science and design system components and processes as per standards with emphasis on privacy, security, public health and safety.

4. Graduates will be able to conduct experiments, perform analysis and interpret data as per the prevailing research methods and to provide valid conclusions.

5. Graduates will be able to select and apply appropriate techniques and use modern software design and development tools. They will be able to predict and model complex engineering activities with an awareness of the practical limitations

6. Graduates will be able to carry out their professional practice in Computer Science & Engineering by appropriately considering and weighing the issues related to society and culture and the consequent responsibilities.

7. Graduates would understand the impact of the professional engineering solutions on environmental safety and legal issues.

8. Graduates will be able to apply design thinking and innovation to provide a more economical and effective solutions.

9. Graduates will be able to function effectively in a large team of multidisciplinary streams consisting of persons of diverse cultures without forgetting the significance of each individual's contribution.

10. Graduates will be able to communicate effectively about complex engineering activities with the engineering community as well as the general society, and will be able to prepare reports.
11. Graduates will be able to demonstrate knowledge and understanding of the engineering and management principles and apply the same while managing projects in multidisciplinary environments.
12. Graduates will engage themselves in self and life-long learning in the context of rapid technological changes happening in Computer Science and other domains.

Programme Educational Objectives (PEOs)

PEO1: Applying basic and advanced principles of mathematics, science and engineering in designing and developing solutions for real life problems using modern engineering tools.

PEO2: Have extensive and effective practical skills in computer science and engineering and the ability to analyze and interpret experimental results in frontier areas of Computer Science and Engineering and appetite for higher learning and research in multidisciplinary areas.

PEO3: Engage in professional development with effective communication, ethical and team work and adopt current trends through lifelong learning.

PEO4: Apply design thinking and become more innovative in providing the solutions.

Course Outcomes (COs):

1	Test the convergence of an infinite series and express a function in terms of power series.
2	Apply the techniques of multivariable differential calculus to determine extrema and series expansions of a function of several variables.
3	Extend the concept of integration to higher dimensions and use it to solve problems in engineering.
4	Solve a linear system of equations analytically and compute eigenvalues and eigen vectors of a square matrix
5	Diagonalize a matrix and identify the nature of a quadratic form.

Course Outcome versus **Program Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	S	S										
CO-2	S	M										
CO-3	S	S										
CO-4	S	S										
CO-5	S	S										

S - Strongly correlated, *M* - *Moderately* correlated, *Blank* - *No correlation*

Assessment Methods:	Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam

Teaching-Learning and Evaluation

Week	TOPIC / CONTENTS	Course Outcomes	Sample questions	TEACHING-LEARNING STRATEGY	Assessment Method & Schedule
1	Sequence, infinite series tests for convergence: comparison test, ratio Test, root test.	**CO-1**	Test for the converge the series $\sum_{n=1}^{\infty}\left(\frac{n!3^n}{n^n}\right)$	Lecture / Problem solving	Assignment (Week 2 - 4) / Quiz-I (Week -8)/ Mid-Test 1 (Week 9)
2	Rolle's theorem, Lagrange's and Cauchy's mean value theorem	**CO-1**	Apply Lagrange's Mean Value theorem for $f(x)=(x-1)(x-2)(x-3)$ in [0,4]	Lecture / Problem solving	Assignment (Week 2 - 4)/ Quiz -I (Week -8)/ Mid-Test 1 (Week 9)
3	Expansions of functions: Taylor's and Maclaurin's series	**CO-1**	Use Taylor's series expansion for $\sin^{-1}x$ in powers of x and y up to third degree	Lecture / Problem solving	Mid-Test 1 (Week 9)/ Assignment (Week 2 - 4)/ Quiz -I (Week -8)
4	Total derivative, change of variables, Jacobin's	**CO-2**	If $x = u(1-v),\ y = uv$, then determine $\frac{\partial(u,v)}{\partial(x,y)}$	Lecture / Problem solving	Mid-Test 1 (Week 9)/ Quiz -I (Week -8)
5	Taylor's theorem for functions of two variables	**CO-2**	Determine the Taylor's series expansion of $e^x \sin y$ in powers of x and y	Lecture / Problem solving	Mid-Test 1 (Week 9) / Quiz -I (Week -8)
6	Maxima and minima of functions of two variables, Lagrange method of undetermined multipliers	**CO-2**	In the plane triangle ABC, determine the maximum value of $\cos A \cos B \cos C$	Lecture / Problem solving	Mid-Test 1 (Week 9)/ Quiz -I (Week -8)
7	Non Cartesian Coordinates, Double integrals, Change of order of integration.	**CO-3**	Evaluate $\int_{-1}^{2}\int_{x^2}^{x+2} dy\,dx$.	Lecture / Problem solving	Mid-Test 1 (Week 9) / Quiz -I (Week -8)
8			**Mid-Test 1**	-------	----------
9	Double integral in polar co-ordinates Triple integrals, Change of variables in double integral.	**CO-3**	Evaluate $\int_0^{\infty}\int_0^{\infty} e^{-(x^2+y^2)}\,dxdy$ by changing to polar coordinates.	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)/ Assignment (12-14)

10	Double integral in polar co-ordinates Triple integrals, Change of variables in double integral.	**CO-3**	Evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}\, dxdy$ by changing to polar coordinates.	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)/ Assignment (12-14)
11	Change of variables in triple integral, Simple Applications of multiple integrals.	**CO-3**	Evaluate $\int_{x=0}^{1} \int_{y=0}^{x} \int_{z=0}^{x+y} x\, dzdydx.$	Lecture / Problem solving	Assignment (Mid-Test 2 (Week 18) / Quiz -II (Week -17)/ Assignment (12-14)
12	Rank of a matrix (echelon form and normal form	**CO-4**	Determine the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)/ Assignment (12-14)
13	Consistency of linear system of equations	**CO-4**	Discuss the consistency of linear system of equations $4x-2y+6z=8,$ $x+y-3z=-1,$ $15x-3y+9z=21$	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)
14	Eigen values and eigen vectors of a matrix, properties of eigen values	**CO-4**	Determine the eigen values and eigen vectors for the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$, Two eigen values of the matrix $A=\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ are equal to 1 each.Find the eigen value of A^{-1}	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)
15	Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem	**CO-5**	Using Cayley –Hamilton theorem find the inverse of $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ 2 & -4 & -4 \end{bmatrix}$, find A^4	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)
16	Reduction to diagonal form,	**CO-5**	Determine the eigen values and eigen vectors and hence reduce the matrix $A=\begin{bmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{bmatrix}$ to a	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)

			diagonal form		
17	Reduction of quadratic form to canonical form, nature of the quadratic form	**CO-5**	Discuss the nature of the quadratic form by reducing to canonical form $3x^2+5y^2+3z^2-2yz+2zx-2xy$	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)
18	**Mid-Test 2**				
19/20	**END EXAM**				