Institute/School/College Name	Chitkara University Institute of Engineering & Technology		
Department/Centre Name	Department of Applied Sciences		
Programme Name	B.E.-CSE		
Course Name	Calculus and Statistical Analysis	Session	2022 - 2023
Course Code	AS22001	Semester/Batch	Ist /2022
Lecture/Tutorial (Per Week)	4-1-0	Course Credit	5
Course Coordinator Name	Dr. Renu Bala		

1. **Objective of the Course:**

- To provide the ability to apply mathematics for the solution of complex engineering and real life problems.
- To Identify, formulate and analyse the engineering problems.
- To arrive at substantiated conclusions using principles of mathematics are covered.

The main objectives of the courses are:

- To design matrices for mathematical problems related to real life and find their solutions.
- To analyse functions of two or more variables and compute their derivatives for finding extreme values of surfaces.
- To apply techniques of evaluating double and triple integral to solve various engineering problems.
- To implement various hypothesis testing techniques for small and large sample data and calculate coefficient of correlation, line of regression to describe relation between independent variable and dependent variable.

2. **Course Learning Outcome:**

	Course Outcome	POs	CL	KC	Sessions
CLO01	Students will be able to introduce and form matrices to present mathematical solutions in a concise and informative manner. Use matrices to solve the problems of system of linear equations and solve various live problems using matrices.	PO1,PO3,PO10	K2	Factual Conceptual	**3**
CLO02	Students will be able to find local extreme values of functions of several variables, test for saddle points, examine the conditions for the existence of absolute extreme values. Solve constraint problems using Lagrange multipliers and solve related application problems.	PO1,PO2,PO3,PO4,PO12	K3	Fundamental Conceptual	**7**
CLO03	Students will be able to apply the principles of Integral Calculus to solve a variety of practical	PO3,PO5,PO12	K3	Conceptual Procedural	**5.5**

	problems in Engineering and applied Sciences.				
CLO04	Students will be able to interpret statistical inference tasks with the help of probability & distributions and hypothesis testing for means, variances and proportions of large as well as small data and employ appropriate regression models in determining statistical relationships.	PO2,PO3,PO5,PO9,PO11,PO12	K3	Conceptual Procedural	**5.5**
Total Contact Hours					**31.5**

Revised Bloom's Taxonomy Terminology

*Cognitive Level =CL

*Knowledge Categories = KC

Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	**H**	**H**		**H**								
CLO2	**H**	**H**										
CLO3	**H**		**M**									**H**
CLO4	**H**	**H**										**M**

3. ERISE Grid Mapping

Feature Enablement	Level(1-5, 5 being highest)
Entrepreneurship	2
Research	4
Innovation	3
Skills	5
Employability	4

4. Recommended Books (Reference Books/Text Books):

B01: Advanced Engineering Mathematics, Erwin Kreyszig, Wiley India Pvt. Ltd

B02: Engineering Mathematics, Srimanta Pal &Subodh C. Bhunia, Edition 2015, Oxford University Press.

B03: The Engineering Mathematics, 2nd Edition, Chitkara University Publication, Vol. I.

B04: Higher Engineering Mathematics, B.V. Ramana, Tata McGraw-Hill Education.

B05: Advanced Engineering Mathematics, R.K. Jain and S.R.K. Iyengar, Alpha Science International Ltd.

B06: Higher Engineering Mathematics, B.S. Grewal, Khanna Publications.

B07: A text book of Engineering Mathematics, N. P. Bali and Manish Goyal, Laxmi Publications.

B08: Calculus, by Howard Anton, Irl Bivens Stephens Davis

B09: Advanced Engineering Mathematics, H.C. Taneja, I.K. International, Vol I.
B10: Introduction to Probability and Statistics for Engineers and Scientists 4th edition, Sheldon M. Ross, Academic Press, Elsevier.

5. **Other readings & relevant websites:**

S.N.	Link of Journals, Magazines, websites and Research Papers
1.	http://www.nptelvideos.com/video.php?id=67&c=1
2.	http://www.nptelvideos.com/video.php?id=71&c=1
3.	http://www.nptelvideos.com/video.php?id=91&c=1
4.	http://mathinsight.org/partial_derivative_examples
5.	http://www.studyyaar.com/index.php/module/58-multiple-integrals-and-their-applications
6.	www.intmath.com/Matrices-determinants/Matrix-determinant-intro.php
7.	http://nptel.ac.in/courses/111105041/23

6. **Course Plan:**

Session No.	Topics	Recommended Books
0.5	**Prerequisite** Differentiation: Geometrical interpretation of derivative, Indefinite and definite (integration by substitution, by parts, by partial fraction) Reduction formulae sine and cosine (with limit 0 – π/2)	B6
0.5 -1.5	**Matrices**: Review of matrices and determinants, Elementary operations, rank, Inverse of matrix, Normal form	B6
1.5 - 2	Solution of a system of linear equations by using rank,	B6
2 – 2.5	Characteristics equations , Eigen values and Eigen vectors	B7
2.5 - 3	Cayley Hamilton theorem(without proof), Diagonalization, Quadratic form & Canonical form,	B7
3 – 3.5	**Introduction to Partial Derivatives:** Function of several variables, Limit and continuity	**B7**
3.5 – 4.5	Partial Differentiation, Euler's Theorem	B6
4.5 - 6	Tangent and Normal, Partial Derivative of Composite Functions, Implicit Functions	B6
6 - 7	Total derivatives, Error & Approximation.	B6
	ST-1	
7 - 8	Jacobians with properties, Taylor's Series Expansion, Maclaurin's Series (one & two variables).	B4
8 – 8.5	Application: Maxima and Minima of functions of two and three variables	B4
8.5 - 9	Lagrange's method of Undetermined Multipliers	B4
9 – 10	Sketch some standard Cartesian and Polar curves using Curve tracing - Cardiod, Leminscate, Folium of Descartes, Three/Four Leaved Rose, Limacon Cissoid,	B4
10 – 11.5	**Multiple Integration and its Applications:** Reduction formulas, Introduction to Double Integration using Cartesian & polar coordinate	**B4**
11.5– 12.5	Change of order in double integration, Introduction to Triple Integration	B4
12.5 – 13	Change of variables in Polar, Cylindrical and Spherical Coordinates	B4
13 - 13.5	Applications of multiple integral to find Area enclosed by Plane curves	**B4**

13.5 -14.5	Applications of multiple integral to find Volume, Moment of Inertia, Centroid, Centre of Gravity	B4
14.5 - 15.5	Improper integrals of first and second kind, Special Functions: Beta and Gamma functions	**B4**
ST-2		
15.5 - 16.5	**Probability and Statistical Methods:** Random variable(discrete and continuous), Binomial, Poisson	**B5**
16. 5 - 18	Normal, exponential distribution.	**B5**
18 - 19.5	Hypothesis Testing (General concepts, Testing a Statistical hypothesis, one and two tailed tests, Critical region, Confidence interval estimation, Single and two sample tests on proportion), mean and variance	**B5**
19.5 – 20.5	Sampling Distribution of means and variance, t-distribution and F-distribution,	B5
20.5 - 21	Correlation ,lines of regression(two variable only)	**B5**
END TERM – FULL SYLLABUS		

7. Delivery/Instructional Resources

Lecture No.	**Topics**	**PPT** *(link of ppts on the central server)*	**Industry Expert Session***(If **yes**: link of ppts on the central server)*	**Web References**	**Audio-Video**
0.5	Prerequisite Differentiation: Geometrical interpretation of derivative, Indefinite and definite (integration by substitution, by parts, by partial fraction), Reduction formulae sine and cosine (with limit $0 – \pi/2$)	https://docs.google.com/presentation/d/1vrZY0sHDOg7ylrsnt7PZzQSWQNZbDS	**NA**	https://nptel.ac.in/courses/122/104/122104018/	**https://www.youtube.com/watch?v=EJ8Ptnk7dzU&t=1002s**
0.5-3	Matrices: Review of matrices and determinants, Elementary operations, rank, Inverse of matrix, Normal form Solution of a system of linear equations by using rank Characteristics equations , Cayley Hamilton theorem(without proof) Eigen values and vectors Diagonalization, Quadratic form & Canonical form,	https://docs.google.com/presentation/d/1vrZY0sHDOg7ylrsnt7PZzQSWQNZbDSDU/edit	**NA**	https://nptel.ac.in/courses/122/104/122104018/	**https://nptel.ac.in/courses/122/104/122104018/**

3 - 9	Introduction to Partial Derivatives: Function of several variables, Limit and continuity Partial Differentiation, Euler's Theorem Tangent and Normal, Partial Derivative of Composite Functions, Implicit Functions Total derivatives, Error & Approximation. Jacobians with properties, Taylor's Series Expansion, Maclaurin's Series (one & two variables). Application: Maxima and Minima of functions of two and three variables Lagrange's method of Undetermined Multipliers	https://docs.google.com/presentation/d/1vrZY0sHDOg7ylrsnt7PZzQSWQNZbDSDU/edit	**NA**	https://nptel.ac.in/courses/111/107/111107108/	**https://nptel.ac.in/courses/111/107/111107108/**
9 – 10	Sketch some standard Cartesian and Polar curves using Curve tracing - Cardiod, Leminscate, Folium of Descartes, Three/Four Leaved Rose, Limacon Cissoid,	https://docs.google.com/presentation/d/1vrZY0sHDOg7ylrsnt7PZzQSWQNZbDSDU/edit	**NA**	https://www.youtube.com/watch?v=OAEjSiFGdhQ	**https://www.youtube.com/watch?v=IAb98ZgSJNw**
10 – 15.5	Multiple Integration and its Applications: Reduction formulas, Introduction to Double Integration using Cartesian & polar coordinate Change of order in double integration, Introduction to Triple Integration. Change of variables in Polar, Cylindrical and Spherical Coordinates. Applications of multiple integral to find Area enclosed by Plane curves Applications of multiple integral to find Volume, Moment of Inertia, Centroid, Centre of Gravity. Improper integrals of first and second kind, Special Functions: Beta and Gamma functions	https://docs.google.com/presentation/d/1vrZY0sHDOg7ylrsnt7PZzQSWQNZbDSDU/edit	**NA**	https://nptel.ac.in/courses/111/107/111107108/	**https://nptel.ac.in/courses/111/107/111107108/**
15.5 - 21	Probability and Statistical Methods: Random variable(discrete and continuous), Binomial, Poisson Normal, exponential distribution. Hypothesis Testing (General concepts, Testing a Statistical hypothesis, one and two tailed tests, Critical region, Confidence interval estimation, Single and two sample tests on proportion),	https://docs.google.com/presentation/d/1vrZY0sHDOg7ylrsnt7PZzQSWQNZbDSDU/edit	NA	https://nptel.ac.in/courses/111/105/111105041/	https://nptel.ac.in/courses/111/105/111105041/

	mean and variance Sampling Distribution of means and variance, t-distribution and F-distribution, Correlation ,lines of regression(two variable only)				

8. Action plan for different types of learners

Slow Learners	Average Learners	Fast Learners
Extra Class on Saturday. Doubt sessions.	Doubt-sessions	Doubt Sessions

9. Evaluation Scheme & Components:

Evaluation Component	Type of Component	No. of Assessments	Weightage of Component	Mode of Assessment
Component 1	Sessional Tests (STs)	02*	40%	Offline
Component 2	End Term Examinations	01	60%	Offline
Total		**100%**		

* Out of 2 ST's the ERP system automatically picks the best 01 ST mark for evaluation.

Details of Evaluation Components:

Evaluation Component	Description	Syllabus Covered (%)	Timeline of Examination	Weightage (%)
Component 01	ST 01	Up to 40%	As defined in Academic Calendar	40%
	ST 02	41% - 80%	As defined in Academic Calendar	
Component 02	End Term Examination*	100%	At the end of the semester	60%
Total				100%

*As per Academic Guidelines minimum 75% attendance is required to become eligible for appearing in the End Semester Examination.

Evaluation Components of Sessional Test and End Term Examination

Type of Assessment	Time of Conduction	Total Marks	Question Paper Format		
			1 Mark MCQ	2 Mark questions	5 Mark questions
Sessional Test 1	1-7 Sessions	40	10	20	2
Sessional Test 2	7 - 15.5 Sessions	40	10	20	2
End Term Examination		60	30	15	

10. Syllabus of the Course:

Name of the course: Calculus and Statistical Analysis	**Subject Code:AM121**	
Contents	**No. of Sessions**	**Weightage (%)**
Unit 1Matrices: Review of matrices and determinants, Elementary operations, rank, Inverse of matrix, Normal form, Cayley Hamilton theorem(without proof), Solution of a system of linear equations by using rank, Characteristics equations, Eigen values and vectors, Diagonalization, Canonical form, Quadratic form.	**3**	**17.5**
Unit 2 Partial Differentiation & its Applications: Introduction to Partial Derivatives: Function of several variables, Limit and continuity Partial Differentiation, Euler's Theorem, Total derivatives, Error & Approximation, Tangent and Normal. Partial Derivative of Composite Functions, Implicit Functions, Jacobians(with properties), Taylor's Series Expansion, Maclaurin's Series (one and two variables).Application: Maxima and Minima of functions of two and three variables, Lagrange's method of Undetermined Multipliers.	**7**	**27.5**
Unit 3 Multiple Integration and its Applications: **CurveTracing:**curve tracing (Cartesian and polar curves)- Cissoid, cardiod, Lemniscate, Folium of Descartes, Three/Four Leaved Rose, Limacon, Introduction to Double Integration using Cartesian & polar coordinate, Change of order in double integration, Introduction to Triple Integration ,Change of variables in Polar, Cylindrical and Spherical Coordinates , Applications of multiple integral to find Area enclosed by Plane curves ,Applications of multiple integral to find Volume, Moment of Inertia, Centroid, Center of Gravity, Improper integrals of first and second kind , Special Functions: Beta and Gamma functions	**5.5**	**30**
Unit 4 Probability and Statistical Methods: Random variable (discrete and continuous), Binomial, Poisson, Normal, exponential distribution. Sampling Distribution of means and variance, t-distribution and F-distribution,Hypothesis Testing (General concepts, Testing a Statistical hypothesis, one and two tailed tests, Critical region, Confidence interval estimation. Single and two sample tests on proportion), mean and variance .correlation ,lines of regression(two variable only)	**5.5**	**25**

This Document is approved by:

Designation	**Name**	**Signature**
Course Coordinator	Dr. Renu Bala	
Program Incharge	Dr. Reetu Malhothra	
Dean	Dr. Mohit Kumar Kakkar	
DD/MM/YYYY	11/10/2022	