Mathematical and Statistical Techniques in Computer Science

School: SET		**Batch : 2019**	
Program: M.Tech		**Current Academic Year: 2019-2021**	
Branch: Data Science		**Semester: I**	
1	Course Code	**CSE613**	
2	Course Title	**Mathematical and Statistical techniques in computer science**	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status	PG	
5	Course Objective	The objective of the course is to teach students the mathematical & statistical techniques that provide sound basis for research and application development in Computer Science.	
6	Course Outcome	CO1: Identify errors from different dimensions and defining roots of equations for the use in computational problems CO2: Apply Differential and Numerical Integration for interpolation and error analysis CO3: Discover linearly independent components using eigenvectors and standard value decomposition. CO4: Formulate Exploratory data analysis using spectral methods like Fourier and wavelet analysis. CO5: Illustration of best Curve fitting for given data CO6: Apply mathematical and statistical methods in their research and application development	
7	Course Description	In this subject, the fundamental concepts and principles of Mathematical & Statistical Techniques together with the challenging issues in Computer will be introduced.	
8	Outline syllabus		CO Mapping

	Unit 1	**Introduction, Computational Errors and their Analysis**	
	A	Accuracy of numbers, Errors and a general error formula, Errors in Numerical Computations and Inverse Problems	CO1, CO6
	B	Floating Point Representations of Numbers and operations, Errors in a Series Approximation	CO1, CO6
	C	Algebraic & Transcendental Equations: Order of convergence of iterative and bisection methods, Convergence of a Sequence, Iterative methods for system of non-linear equations, Regular Falsi method	CO1, CO6
	Unit 2	**Algorithmic Optimization**	
	A	Assumptions for interpolation, errors in polynomial interpolation, finite differences, difference operators and their relationship, Newton's interpolation formula	CO2, CO6
	B	Introduction to numerical differentiation, Introduction to numerical integration, Trapezoidal and Simpson's rules,	CO2, CO6
	C	Introduction to numerical solution of ordinary differential equations, Euler's method.	CO2, CO6
	Unit 3	**Vector Calculus**	
	A	Scalar functions of several variables, Partial derivatives and differentiability, gradient vector, vector fields	CO3, CO6
	B	Linear Systems, Orthogonality, Eigenvalues & Eigenvectors: Vector spaces, Linear maps, Systems of linear equations, Orthogonality, orthogonal projections, Eigenvalues & Eigenvectors.	CO3, CO6
	C	QR & Singular value decomposition	CO3, CO6
	Unit 4	**Spectral Methods**	
	A	Time Series Analysis (Introduction to classical methods),	CO4, CO6
	B	Fourier Analysis: Introduction to Fourier and their applications in knowledge discovery & exploratory data analysis.	CO4, CO6
	C	Wavelet Analysis: wavelet transform and their applications in knowledge discovery & exploratory data analysis.	CO4, CO6

	Unit 5	**Regression analysis, Techniques for statistical quality control, Testing of hypothesis.**			
	A	Curve fitting: Principle of least squares Fitting of $y=aebx$, $y=ax^b$, $y=ab^x$.			CO5, CO6
	B	Techniques for statistical quality control,			CO5, CO6
	C	Testing of hypothesis.			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. MatheusGrasselli and DimitryPelinovsky, "Numerical Mathematics", Jones and Bartlet Publishers, USA. 2. M. Goyal, "Computer Based Numerical & Statistical Techniques", Infinity Science Press, LLC, MA, USA.			
	Other References	1.Lars Elden, "Mattrix Methods in Data Mining and Pattern Recognition", SIAM (Society for Industrial and Applied Mathematics), USA. 2. Internet as a resource for references			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Identify errors from different dimensions and defining roots of equations for the use in computational problems	PO1, PO2, PO3, PO4, PO8, PSO2, PSO3
2.	CO2: Apply Differential and Numerical Integration for interpolation and error analysis	PO1, PO2, PO3, PO4, PO8, PSO2, PSO3
3.	CO3: Discover linearly independent components using eigenvectors and standard value decomposition.	PO1, PO2, PO3, PO4, PO8,

		PSO2, PSO3
4.	CO4: Formulate Exploratory data analysis using spectral methods like Fourier and wavelet analysis.	PO1, PO2, PO3, PO4, PO8, PSO2, PSO3
5.	CO5: Illustration of best Curve fitting for given data	PO1, PO2, PO3, PO4, PO8, PSO2, PSO3
6.	CO6: Apply mathematical and statistical methods in their research and application development	PO1, PO2, PO3, PO4, PO8, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Mathematical and Statistical techniques in Computer Science (Course Code CSE613)

Course	Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3
Mathematical	CO1	3	2	1	1	-	-	-	2	-	3	1
	CO2	3	3	1	1	-	-	-	2	-	2	1
	CO3	3	3	1	2	-	-	-	2	-	3	1

and Statistical techniques (Course Code CSE 613)												
	CO4	3	2	1	2	-	-	-	2	-	3	1
	CO5	3	2	1	2	-	-	-	3	-	3	1
	CO6	3	2	1	2	-	-	-	3	-	3	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3
CSE613	Mathematical and Statistical techniques	3	2.3	1	1.4	0	0	0	2.3	0	2.8	1

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***