



Course Name: Mathematics-III
Course Code: CSD-306
(Semester III)
Course Broad Category: B. Tech CSD

1. Course Prerequisite:

Concept of Mathematics in B. Tech 1st and 2nd semester.

2. Course Learning Objectives:

This module provides students with essential mathematical tools for analyzing and solving real-world problems. It introduces concepts of probability, including random variables, key distributions, and stochastic processes like Markov chains and Poisson Processes. Students will learn statistical methods such as measures of central tendency, correlation, regression, curve fitting, and hypothesis testing for data analysis. Numerical approximation techniques are covered, focusing on interpolation and solving nonlinear equations while understanding numerical errors and solution of ODE by numerical Methods. The module also explores methods for solving optimization problems involving single variable and multivariable functions.

3. Teaching methodology and evaluation system for the course:

Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies, Guest Lectures.

Evaluation System –

- A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
- B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
- C. End-Semester Exam (60 Marks)- Summative Assessment.

4. Course Content:

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Course Code: CSD- 306 (CSD)

Hours per Week: 3L: 1T: 0P

Credits: 3

Module	Topics	45L
1.	Probability: Review on Basic Probability theory, Random Variable, Discrete and Continuous random variables, Mathematical expectation, properties of expectation and variance, Moment Generating functions and Characteristics function, Discrete Probability Distribution (Binomial and Poisson's distribution) and Continuous Probability Distribution (Normal and Exponential distribution). Continuous and Discrete Bivariate distributions and their properties, Conditional and Marginal distributions.	10L

Module	Topics	45L
2.	Stochastics Process: Definition, classification, and examples of stochastic processes; stationary and autoregressive processes; discrete-time Markov chains; continuous-time Markov chains, Poisson process.	8L
3.	Statistics: Law of large numbers, central limit theorem, Chebyshev's inequality, sampling distributions, chi square distribution, Student's 't' distribution, F distribution. Applied Statistics: Correlation and regression – Rank correlation, Curve fitting by the method of least squares- fitting of straight lines. Inferential Statistics: Estimation of Parameters: Point estimation: sufficiency, unbiased estimation, maximum likelihood estimation, confidence intervals for mean, Hypothesis testing: type-I and type-II errors, One and two tailed tests. Test for single mean, difference of means, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	12L
4.	Approximation in numerical computation: Motivation and application, Rounding off a number, Different types of error (Significant, inherent, Truncation etc.), Different kinds of difference operators. Interpolation- Newton forward/ backward interpolation, Lagrange's interpolation formula. Numerical solutions of nonlinear algebraic/transcendental equations: Bisection and Newton-Raphson methods. Solution of ODE: RK4 Method.	9L
5.	Optimization: Hyperplanes and Linear Varieties; Convex and concavity of non-linear function. Introduction and Classical Optimization Techniques: Statement of an Optimization problem, classification of Optimization problems. Classical Optimization Techniques: Single variable Optimization, multi variable Optimization- without constraints, multivariable Optimization with equality constraints- Solution by method of Lagrange multipliers, Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.	6L

5. References:

Text Book:

- Baishnav, D. & Jash, S.: Probability and Statistics, PHI Learning, 2019.
- Kapoor, V.K., and Gupta, S.C.: Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
- Kapoor, V.K., and Gupta, S.C.: Fundamentals of Applied Statistics, Sultan Chand & Sons.
- Medhi, J.: Stochastic Processes, New Age International Publishers.
- Ravindran, Phillips, Solberg: Operations Research Principles and Practices
- M. K. Jain, S.R.K. Iyengar & R.K. Jain: Numerical Methods for scientific & Engineering Computation.
- E. Kreyszig: Advanced Engineering Mathematics, Wiley Publications

Reference Books:

- Mukhopadhyay, P.: Mathematical Statistics, New Central Book Agency.
- Dreyfus, S.E.: The Art and Theory of Dynamic Programming: Theory and Applications, Academic Press.

- Goon, A.M., Gupta, M.K., and Dasgupta, B.: Outlines of Statistics, Vol. II, The World Press Private Ltd.
- Hoel, P.G.: Introduction to Mathematical Statistics, John Wiley & Sons.
- Hogg, R.V., Tanis, E.A., and Rao, J.M.: Probability and Statistical Inference (7th Edition), Pearson.
- Kalyanmoy Deb, “Optimization for Engineering Design – Algorithms and Examples”, PHI Learning Pvt. Ltd, New Delhi, 2005.
- Stephen G. Nash, A. Sofer: Linear and Non-linear Optimization, McGraw Hill
- S.S. Sastry: Introductory methods of Numerical Analysis, PHI learning. Hogg, R.V. & Craig, A.T.: *Introduction to Mathematical Statistics*, Pearson.
- Spiegel, M.R., Schiller, J. & Srinivasan, R.A.: *Probability and Statistics (Schaum's Outline Series)*, McGraw-Hill.

6. Course Outcomes (CO):

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CSD-306.1	Learn to apply different tools in basic probability theory which would enable them to devise engineering solutions to encounter in their profession life.	Identify	Remember
CSD-306.2	Understand the uncertainties and risks, and to model and analyze the lifetime or failure characteristics of components, systems, or processes.	Explain	Understand
CSD-306.3	Apply statistical tool in analyzing the data in making decisions of any real-life problems.	Implement	Apply
CSD-306.4	Solve complex problems using numerical methods and approximation techniques with precision and accuracy.	Organize	Analyze
CSD-306.5	Formulate and optimize solutions for practical problems by applying systematic and logical approaches.	Assess	Evaluate
CSD-306.6	Build up logical and analytical skills to create a new idea appreciated by academics, research & emerging trends in industry.	Construct	Create

7. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	2	1	-	-	1
2	2	3	1	-	-	1
3	2	1	3	1	-	1
4	1	-	2	3	-	1
5	2	1	2	2	3	1

8. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	1	2	-	-	-	-	-	1
CO2	2	2	2	1	-	-	-	-	-	-	1
CO3	1	2	2	1	1	-	-	-	-	-	1
CO4	1	2	1	1	2	-	-	-	-	-	2
CO5	2	2	2	2	2	-	-	-	-	-	1
CO6	1	1	1	1	-	-	-	-	-	-	1

9. Mapping to Program Specific Outcome (PSO)

	PSO1	PSO2	PSO3
CO1	2	2	1
CO2	3	2	1
CO3	2	1	1
CO4	3	2	1
CO5	3	2	1
CO6	2	1	1