III SEMESTER (Computer Science Allied Branches)

Course Title	Mathematics for Computer Science		
Course Code	22MATS31	CIE Marks	50
Course Type	Theory	SEE Marks	50
Teaching Hours/Week (L: T: P: S)	2:2:0:0	Total Marks	100
Total Hours of Pedagogy	40 hours	Exam Hours	03
		Credits	03

Course objectives:

The goal of the course **Mathematics for Computer Science** is to,

1. Introduce the concept of random variables, probability distributions, specific discrete and continuous distributions with practical application in Computer Science Engineering and social life situations.
2. Provide the principles of statistical inferences and the basics of hypothesis testing with emphasis on some commonly encountered hypotheses.
3. Determine whether an input has a statistically significant effect on the system's response through ANOVA testing.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution of some exercises (post-lecture activity).

Module-1

Probability Distributions:

Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson and normal distributions- problems (derivations for mean and standard deviation for Binomial and Poisson distributions only). . **8 Hours.**

[Text 1: 26.1, 26.2, 26.7, 26.8, 26.9, 26.10, 26.13, 26.14, 26.15, 26.16]

[RBT Levels: L1, L2 and L3]

Self-Study: Exponential distribution.

Applications: Used for Modeling and prediction, analyzing data, algorithm design, cryptography, error

detection, machine learning, computer vision, computer graphics, random number generation and natural language processing.

Module-2

Joint probability distribution & Markov Chain:

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation.

Markov Chain: Introduction to Stochastic Process, Probability Vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states. **8 Hours.**

[Text 3: 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 5.6, 5.7]

[RBT Levels: L1, L2 and L3]

Self-Study: Joint Probability distribution for two continuous random variables.

Applications: Joint distribution for system design and maintenance decisions. Markov chain for algorithmic design and networking.

Module-3

Statistical Inference 1:

Introduction, sampling distribution, standard error, testing of hypothesis, levels of significance, test of significances, confidence limits, simple sampling of attributes, test of significance for large samples, comparison of large samples. Sampling variables, central limit theorem and confidence limit for unknown mean. Test of Significance for means of two large samples. **8 Hours.**

[Text 1: 27.1, 27.2, 27.3, 27.4 27.5, 27.6, 27.7, 27.8, 27.9, 27.10, 27.11, 27.12]

[RBT Levels: L1, L2 and L3]

Self-Study:

Applications: Decision making and problem solving, software testing and quality control

Module-4

Statistical Inference 2:

Sampling of variables-small samples, students 't' distribution, Chi-square distribution as a test of goodness of fit. F-Distribution. **8 Hours.**

[Text 1: 27.13, 27.14, 27.15, 27.16, 27.17, 27.18, 27.19]

[RBT Levels: L1, L2 and L3]

Self-Study: Fisher's Z-Distribution.

Applications: Algorithm performance evaluation, Software testing, Hardware testing, Quality assurance, Biometric systems, Network security, database management, Biomedical informatics, Information retrieval, signal processing and image processing.

- **Module-5**

Design of Experiments and ANOVA:

Principles of experimentation in design, Analysis of completely randomized design, randomized block design. The ANOVA Technique, Basic Principle of ANOVA, One-way ANOVA, Two-way ANOVA, Latin-square Design, and Analysis of Co-Variance. **8 Hours.**

[Text 1:]

[RBT Levels: L1, L2 and L3]

Self-Study:

Applications: Algorithm Optimization, Network performance, Database management, User experience design and Hardware design.

Teaching-Learning Process for all modules	**Chalk and Talk/PowerPoint presentation/YouTube videos.**

Course Outcomes (Course Skill Set):

After successfully completing the course, the students will be able to:

1. Understand the basic concepts of probability, random variables, probability distribution and apply suitable probability distribution models for the given scenario.
2. Learn the concept of joint distribution and make use of the notion of a discrete-time Markov chain and n-step transition probabilities to solve the engineering application problem
3. Use statistical methodology and tools in the sampling analysis.
4. Compute the confidence intervals for the mean of the population by using different tests.
5. Apply the ANOVA test related to engineering problems.

Evaluation Details:

Evaluation Type		Component	Max Marks	Marks Reduced to	Min. Marks	Evaluation Details
Theory Component	Internal Assessment Tests (IAT)	IAT-1	25	25	20	Average of two IATs, Scaled down to 25 marks
		IAT-2	25			
	Comprehensive Continuous Evaluations (CCE)	CCE-1	25	25		Any two Assessment methods as per 22OB4.2 of regulations. Average of two CCEs, scaled down to 25 marks
		CCE-2	25			
	Total CIE -Theory			**50**	**20**	
SEE			100	**50**	**18**	Conducted for 100 marks And scaled down to 50.
CIE + SEE				**100**	**40**	

Suggested Learning Resources:

Text Books:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2021.
2. **Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye** "Probability & Statistics for Engineers & Scientists", Pearson Education, 9th edition, 2017.
3. **Seymour Lipschutz and Marc Lars Lipson:** "Probability", (Chapters: 5 and 8), McGraw Hill Education (India) Private Limited, Chennai, Special Indian Edition, 2010.

Reference Books:

1. **Erwin Kreyszig**, "Advanced Engineering Mathematics", John Wiley & Sons,9th Edition, 2006.
2. **Peter Bruce, Andrew Bruce & Peter Gedeck** "Practical Statistics for DataScientists" O'Reilly Media, Inc., 2nd edition **2020**.
3. **G Haribaskaran** "Probability, Queuing Theory & Reliability Engineering", LaxmiPublication, Latest Edition, 2006.
4. **Irwin Miller & Marylees Miller,** John E. Freund's "Mathematical Statistics with Applications" Pearson. Dorling Kindersley Pvt. Ltd. India, 8th edition, 2014.
5. **S C Gupta and V K Kapoor**, "Fundamentals of Mathematical Statistics", S

Chand andCompany, Latest edition.
6. **Robert V. Hogg, Joseph W. McKean & Allen T. Craig**. "Introduction to Mathematical Statistics", Pearson Education 7th edition, 2013.
7. **Jim Pitman**. Probability, Springer-Verlag, 1993.
8. **Sheldon M. Ross,** "Introduction to Probability Models" 11th edition. Elsevier, 2014.
9. **A. M. Yaglom and I. M. Yaglom**, "Probability and Information". D. Reidel PublishingCompany. Distributed by Hindustan Publishing Corporation (India) Delhi, 1983.
10. **P. G. Hoel, S. C. Port and C. J. Stone**, "Introduction to Probability Theory", UniversalBook Stall, (Reprint), 2003.
11. **S. Ross**, "A First Course in Probability", Pearson Education India, 6th Ed., 2002.
12. **W. Feller**, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley, 3rd Ed., 1968.
13. **N.P. Bali and Manish Goyal**, A Textbook of Engineering Mathematics, LaxmiPublications, Reprint, 2010.
14. **Veerarajan T**, Engineering Mathematics (for semester III), Tata McGraw-Hill, NewDelhi, 2010.

E-Resources:

- http://.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

CO- PO Mapping :

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22MATS31.1	3	3	1									
22MATS31.2	3	3	2									
22MATS31.3	3	3										
22MATS31.4	3	3										
22MATS31.5	2	3	1									
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped												