BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPE51B</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Elective</td></tr>
<tr><td>Course title</td><td colspan="6">PROBABILITY AND STOCHASTIC PROCESSES – THEORY</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - V CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td>2</td><td>2</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="2">Total Max. Marks: 100</td><td colspan="2">Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
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COURSE OBJECTIVES:

The course will enable the students to

Understand the basics of Sampling and Probability theory, Random Variables, and Probability Distributions.

Understand various Standard Distributions and learn how to solve problems.

Understand the basics of Stochastic Processes and different types of stochastic processes.

Learn Discrete-parameter and Continuous-parameter Markov Chains.

Analyze Queuing models and Networks.

UNIT I: INTRODUCTION TO SAMPLING AND PROBABILITY THEORY **09 Hours**

Sampling, Measures of Central Tendency – Mode, Median, Mean, Variance, Standard Deviation. Probability, Events, Types of Events, Addition Rule of Probability, Condition Probability, Independent Events, Multiplication Rule, Law of Total Probability, Bayes' Rule.

UNIT II: RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS **10 Hours**

Random Variables, Discrete Random Variables, Probability Distribution of a Discrete Random Variable, Probability Mass Function, Cumulative Distribution Function of a Discrete Random Variable, Continuous Random Variables, Probability Distribution of a Continuous Random Variable, Probability Density Function, Cumulative Distribution Function of a Continuous Random Variable, Expectation, Variance and Standard Deviation of Discrete and Continuous Random Variables. Covariance and Correlation, Independent Random Variables.

UNIT III: STANDARD DISTRIBUTIONS **10 Hours**

Binomial Distribution, Hyper-geometric Distribution, Poisson Distribution, Geometric Distribution, Negative Binomial Distribution, Exponential Distribution, Uniform Distribution, Normal Distribution, Gamma Distribution, Weibull Distribution, Central Limit Theorem, Two Dimensional Random Variables, Jointly Distributed Random Variables, Marginal Probability Distribution, Conditional Distribution and Conditional Expectation.

UNIT IV: STOCHASTIC PROCESSES **10 Hours**

Introduction, Classification of Stochastic Processes, Types of Stochastic Processes – Strictly Stationary Process, Independent Processes, Renewal Processes, Markov Process, Wide-Sense Stationary Processes, Introduction to Discrete-parameter Markov Chains, Transition Probability Matrix, Time Homogeneity, Computation of One-Step, Two-Step and n-Step Transition Probabilities, Chapman Kolmogorav Equations, Variations of Markov Chains, Global Balance. Discrete-Parameter Birth-Death Processes, Introduction to Continuous-parameter Markov Chains, Birth and Death Process, M/M/m Queue, Pure Birth and Pure Death Processes, Non-Birth-Death Processes.

UNIT V: QUEUING THEORY **09 Hours**

Introduction, Elements of Queuing Model, Distribution of Inter-Arrival Time, Distribution of Service Time, Classification of Queuing Models – Single Server and Multi-Server, Network of Queues, Open Queuing Networks, Closed Queuing Networks, Non-exponential Service-Time Distributions and Multiple Job Types.

TEXT BOOKS:

Kishore S Trivedi, Probability and Statistics with Reliability, Queuing and Computer Science Applications, John Wiley and Sons, II Edition, 2008.

REFERENCE BOOKS:

P Kousalya, Probability, Statistics and Random Processes, Pearson Education, Dorling Kindersley (India), 2013.

L. B. Castananda, V Arunachalam and S Dharmaraja, Introduction to Probability and Stochastic Processes with Applications, John Wiley and Sons, 2012.

Marek Capinski and Tomasz Jerzy Zastawniak , Probability Through Problems, Springer, 2003.

Dimitri P. Bertsekas and John N. Tsitsiklis, Introduction To Probability, Athena Science, II Edition, 2008.

e-BOOKS/ONLINE RESOURCES:

http://www.math.louisville.edu/~pksaho01/teaching/Math662TB-09S.pdf.
https://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability book/amsbook.mac.pdf.
https://faculty.math.illinois.edu/~r-ash/BPT/BPT.pdf.
https://web.ma.utexas.edu/users/gordanz/notes/introduction_to_stochastic_processes.pdf.
http://www.math.harvard.edu/~knill/books/KnillProbability.pdf.

MOOCs:

https://www.edx.org/course/introduction-probability-science-mitx-6-041x-2.
https://www.mooc-list.com/course/probability-coursera.
https://www.youtube.com/channel/UC8uY6yLP9BS4BUc9BSc0Jww.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Apply the concepts of sampling and probability in solving problems.
CO2: Review the differences between discrete and continuous random variables.
CO3: Map the problems to respective probability distributions and solve accordingly.
CO4: Model real world problems to appropriate stochastic models.
CO5: Solve problems using queuing theory.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
<tr><td>Test II (Remaining Two Units) - 20 Marks</td><td>Quiz II – 5 Marks</td><td>25 Marks</td></tr>
<tr><td rowspan="3">SEE – 100 Marks</td><td colspan="2">Q1 (Compulsory): MCQs or Short answer type questions for 15 Marks covering entire syllabus.</td><td>15 Marks</td><td rowspan="3">Total: 100 Marks</td></tr>
<tr><td colspan="2">Q2 & Q3 from Units which have 09 Hours are compulsory.</td><td>17*2= 34 Marks</td></tr>
<tr><td colspan="2">Q4 or Q5, Q6 or Q7 and Q8 or Q9 from Units which have 10 Hours shall have Internal Choice.</td><td>17*3= 51 Marks</td></tr>
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Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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