COURSE CODE	COURSE TITLE	L	T	P	C
1151CS101	CONCRETE MATHEMATICS	3	0	0	3

Course Category: Program Core

A. Preamble:

This course provides an introduction to the basic concepts and techniques of numerical methods, graph theory, random variables, Marko processes properties, distribution, queuing models non-markovianqueuing models and their inter-relations and applications to computer science engineering, and science areas; introduce students to cognitive learning in mathematics; and develops problem solving skills with both theoretical and computer science engineering-oriented problems.

B. Prerequisite Courses:

Sl. No	Course Code	Course Name
1	1150MA202	Engineering Mathematics I

C. Related Courses:

Sl. No	Course Code	Course Name
1	1156CS701	Major Project

D. Course Outcomes:

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Apply numerical methods to find our solution of algebraic equations using different methods under different conditions, and numerical solution of system of algebraic equations.	K3
CO2	Solve problems involving graph models, connectivity paths, connectedness in undirected and directed graphs, Euler and Hamilton paths. shortest-path problem,Trees,Connected Trees	K3
CO3	Calculate probabilities, random processes, stationary randomprocesses, autocorrelation and cross-correlation functions and ergodic processes	K3
CO4	Identify the nature of the process namely Binomial, Poisson, Normal, Markov, Sine wave processes and calculate stationary and transition probabilities.	K3
CO5	Apply the concept of Markovian Queueing models and the concept of non-Markovian queues for obtaining measures of performance of real-time problems under steady state conditions	K3

E. Correlation of COs with POs:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	M											L	L		L
CO2		M		L									H		M
CO3		L													
CO4						L							L		M
CO5											M				L

H- High; M-Medium; L-Low

F. Course Content:

UNIT I Linear Algebraic Equation and Eigen Value Problems **9**

System of equations–solution by Gauss elimination, Gauss-Jordan and LU decomposition method–Jacobi, Gauss-Seidel iteration methods–finding Eigen values of a matrix by Jacobi and power methods Non-Linear system of equations: Graphical method-Newton-Raphson Method-modified Newton-Raphson Method-Method of steepest descent method.

UNIT II Graphs **9**

Simple graphs and multi-graphs – directed multi-graphs – graph models – handshaking theorem – some simple special graphs – representing graphs and graph isomorphism – adjacency and incidence matrices – connectivity paths – connectedness in undirected and directed graphs – Euler and Hamilton paths – shortest-path problems- Trees-Connected Trees

UNIT III Random Processes **9**

Finite probability – probability distributions – conditional probability – independence – Bayes' theorem – mathematical expectation-Definition and description – random processes – stationary random processes – autocorrelation and cross-correlation functions and their properties – ergodic processes

UNIT IV Special Random Processes **9**

Sine wave process – binomial, Poisson and normal processes – Markov process – Markov chains – transition probability matrix – steady-state distribution – classification of states of Markov chains – birth and death process

UNIT V Queueing Theory **9**

Basics of queueing models – (M-M-1) :(∝ /FIFO) model - (M-M-s) :(∝ /FIFO) model -(M-M-1) :(k/FIFO) model - (M-M-s):(k/FIFO) model – (M-G-1) queueing model – Pollaczek-Khinchine formula **TOTAL: 45 Periods**

G. Learning Resources

i. Text Books:

1. S.M. Ross, "Introduction to Probability Models", eighth edition, Academic Press, San Diego, 2004.
2. B.S. Grewal, "Numerical Methods in Engineering and Science", eighth edition, Khanna Publishers, New Delhi, 2008
3. John J. Shynk, Probability, Random Variables, and Random Processes: Theory and Signal, Wiley, 2012.
4. Scott L. Miller, Donald and G. Childers, Probability and Random Processes: With Applications to Signal Processing and Communications, Academic Press, 2012.

5. Kishor S. Trivedi, Probability & Statistics with Reliability, Queuing and Computer Applications, Second Edi., Prentice Hall of India ,2008.
6. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Probability & Statistics for Engineers & Scientists, Prentice Hall, 9th Edi., 2010.
7. P.Z.PeeblesJr.Probability, Random Variables are Random Signal Principles, Tata McGraw Hill, New Delhi,2002

ii. Online resources

1. www.algebra.com › Algebra › College › Linear Algebra
2. www.richland.edu/james/lecture/m116/matrices/pivot.html
3. www.youtube.com/watch?v=wTlAUfv_O4s
4. www.sfb649.wiwi.hu-berlin.de/fedc_homepage/xplore/.../node39.htm
5. www.ergodic.ugr.es/cphys/LECCIONES/FORTRAN/power_method.pdfl
6. http://www.cs.cornell.edu/home/kleinber/networks-book/networks-book-ch02.pdf
7. http://www.math.fsu.edu/~pkirby/mad2104/SlideShow/s6_2.pdf
8. http://www.mathcove.net/petersen/lessons/get-lesson?les=2
9. www.am.qub.ac.uk/users/g.gribakin/sor/chap1a.pdf
10. www.slideshare.net/guest44b78/probability-concepts-applications
11. www.vassarstats.net/bayes.html
12. www.borooah.com/teaching/microeconomics/bayes.pdf
13. www.ccs.neu.edu/course/.../probability/conditionalprobability.pdf
14. www.cems.uvm.edu/~dben/chris_probability.ppt - united states
15. en.wikipedia.org/wiki/moment-generating_function
16. www.courses.ncssm.edu/math/stat_inst/pdfs/sec_2_f.pdf
17. www.statlect.com › additional topics in probability theory