Course No.	Course Name	L-T-P - Credits	Year of Introduction
MA204	**Probability distributions, Random Processes and Numerical Methods**	**3-1-0-4**	**2016**

Prerequisite: Nil

Course Objectives

- To introduces the modern theory of probability and its applications to modelling and analysis and processing of random processes and signals.
- To learn most of the important models of discrete and continuous probability distributions and widely used models of random processes such as Poisson processes and Markov chains.
- To understand some basic numerical methods for interpolation and integration and also for finding roots of equations and solutions of ODEs.

Syllabus

Discrete random variables- Continuous Random variables-Multiple Random variables.
Random Processes- Autocorrelation, Power spectrum-Special Random Processes.
Numerical Methods.

Expected outcome .

At the end of the course students would have become familiar with quantifying and analysing random phenomena using various models of probability distributions and random processes. They would also have learned the concepts of autocorrelation and power spectral density which are useful in the analysis of random signals. Some of the fundamental numerical methods learned in the course would help them to solve a variety of mathematical problems by the use of computers when analytical methods fail or are difficult.

Text Book:

1. V.Sundarapandian, "Probability, Statistics and Queueing theory", PHI Learning, 2009
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th edition, Wiley, 2015.

References:

1. Hossein Pishro-Nik, "Introduction to Probability, Statistics and Random Processes", Kappa Research, 2014 (Also available online at www.probabilitycourse.com)
2. OliverC.Ibe,FundamentalsofAppliedProbabilityandRandomProcesses"Elsevier,2005.
3. T Veerarajan "Probability Statistics and Random Process" Third edition-Mc Graw Hill.
4. Numerical Mathematical and computing –Ward-Cheney-Cengage Learning-7th Edition

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	**Discrete random variables [Text 1: Relevant portions of sections 2.1, 2.2,2.3, 2.5, 3.3 and 3.4]** Discrete random variables, probability mass function, cumulative distribution function, expected value, mean and variance. Binomial random variable-, mean, variance.	3 2	15%

	Poisson random variable, mean, variance, approximation of binomial by Poisson.	2	
	Distribution fitting-binomial and Poisson.	2	
	Continuous random variables [Text 1: Relevant portions of sections 2.4, 2.5, 3.7, 3.8 and 3.11]		
	Continuous random variables, Probability density function, expected value, mean and variance.	2	
II	Uniform random variable-, mean, variance.	2	
	Exponential random variable-mean, variance, memoryless property.	2	
	Normal random variable-Properties of Normal curve mean, variance (without proof), Use of Normal tables.	3	15%
	FIRST INTERNAL EXAMINATION		
	Joint distributions [Text 1: Relevant portions of sections 4.1, 4.2, 4.4 4.7and 4.10]		15%
III	Joint probability distributions- discrete and continuous, marginal distributions, independent random variables.	4	
	Expectation involving two or more random variables, covariance of pairs of random variables.	3	
	Central limit theorem (without proof).	2	
	Random processes [Text 1: Relevant portions of sections 5.1, 5.2, 5.3 and 6.2]		15%
	Random processes, types of random processes,	2	
IV	Mean, correlation and covariance functions of random processes, Wide Sense Stationary (WSS) process, Properties of autocorrelationand auto covariance functions of WSS processes.	4	
	Power spectral density and its properties.	2	
	SECOND INTERNAL EXAMINATION		
	Special random processes [Text 1: Relevant portions of sections 5.5, 5.5.1, 5.5.2, 5.5.3,5.5.4) and 5.6]		20%
V	Poisson process-properties, probability distribution of inter arrival times.	4	
	Discrete time Markov chain- Transition probability matrix, Chapman Kolmogorov theorem (without proof), computation of probability distribution and higher order transition probabilities, stationary distribution.	5	
	Numerical Methods [Text 2: Relevant portions of sections 19.2, 19.3, 19.5 and 21.1]		20%
	(Derivation of formulae not required in this module)		
	Finding roots of equations-Newton-Raphson method.	3	
VI	Interpolation-Newton's forward and backward difference formula, Lagrange's interpolation method.	3	
	Numerical Integration-trapezoidal rule, Simpson's 1/3rd rule.	3	
	Numerical solution of first order ODE-Euler method, Runge-Kutta fourth order (classical method).	3	
	END SEMESTER EXAM		

QUESTION PAPER PATTERN:

Maximum Marks : 100 Exam Duration: 3 hours

The question paper will consist of 3 parts.

Part A will have 3 questions of 15 marks each uniformly covering modules I and II. Each question may have two sub questions.

Part B will have 3 questions of 15 marks each uniformly covering modules III and IV. Each question may have two sub questions.

Part C will have 3 questions of 20 marks each uniformly covering modules V and VI. Each question may have three sub questions.

Any two questions from each part have to be answered.