Academic Course Description

<div style="border">

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Electronics and Communication Engineering

BMA504 - RANDOM PROCESS
Fifth Semester, 2017-18 (Odd Semester)

</div>

Course (catalog) description

> To impart adequate knowledge about probability concepts
> To make students understand Moment Generating Functions

Compulsory/Elective course :   Compulsory course for ECE students

Credit & Contact hours   :   4 & 75

Course Coordinator   :   Mr KrishnaKumar, Assoc. Professor.

Instructor(s)   :

Name of the instructor	Class Handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
Mr KrishnaKumar	III ECE	SA block			12.30 – 1.45 PM

Relationship to other courses:

Pre –requisites   :   Mathematics II

Assumed knowledge   :   *Basic knowledge on* probability and random variables.

Following courses   :   Wireless Networks

Syllabus Contents

UNIT I PROBABILITY AND RANDOM VARIABLES   9+6
Probability concepts, Bayes' theorem, Random variables. Moments, Moment Generating function, Binomial, Poisson, Geometric, Exponential, and Normal distributions. Univariate Transformation of random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES   9+6
Marginal and conditional distributions, Covariance, Correlation and regression, Transformation of random variables, Central limit theorem-Lindberg and Liapounouff Theorems (applications).

UNIT III RANDOM PROCESSES   9+6
Classification, Stationary and Markov processes, Binomial process, Poisson process, Sine-wave process, Ergodic processes.

UNIT IV CORRELATION FUNCTION   Q   9+6
Auto correlation for discrete and continuous processes, Cross correlation functions, Correlation integrals.

UNIT V SPECTRAL DENSITIES   9+6
Power spectral density, Cross spectral density, Applications to linear systems with random inputs

TOTAL 75 HOURS

Text Books:
1. S.C.Gupta & V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, New Delhi , 2003.
2. O Flynn M., " Probability, Random Variables and Random Processes", Harperand RowPublishers, New York, (1982).

References:
1. Peebles Jr.,"Probability, Random Variables and Random Signal Principles", McGraw Hill Publishers, (1987).
2. Ochi M.K., "Applied Probability and Stochastic Processes ", Wiley India Pvt Ltd, New Delhi.
3. Douglas C.Montgomory, George C.Runger, and Norma F.Hubele. "Engineering Statistcs" 4th Edn. Wiley India Pvt Ltd., New Delhi. 2007.
4. Ronald E.Walpole. "Probability and Statistics for Engineers and Scientists". 9th Edn. 2014.
5. Pearson Education, Chennai-600113
6. www.math.chalmers.se/Stat/.../CTH/.../091

Computer usage: Nil

Professional component

General	-	0%
Basic Sciences	-	100%
Engineering sciences & Technical arts	-	0%
Professional subject	-	0%

Broad area : Networking

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	August 2nd week	Session 1 to 25	2 Periods
2	Cycle Test-2	September 2nd week	Session 26 to 50	2 Periods
3	Model Test	October 2nd week	Session 1 to 75	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

To develop problem solving skills and to impart adequate knowledge about probability concepts Moment Generating Functions	Correlates to program outcome		
	H	M	L
1. After completing this course students would be able to apply concepts of Probability to solve problems in Electronic Engineering.	a,h,i,k	f,g	
2. Find functional relationship between random inputs and outputs with the use of Random Process Techniques	a,c	b	
3. Find the linearity in Birth and Death Processes with the use of Poisson processes.	a,d	e,f	j
4. To make students understand Discrete and Continuous Random variables, Random Processes and their applications in Electronic Transmissions	a,e	c,g,k	h
5. To Understand about the correlation Functions	a,g	b,d,i	
6. Find the trend information from discrete data set through numerical differentiation and	a,f	b,e,i,j	

H: high correlation, M: medium correlation, L: low correlation

DRAFT LECTURE SCHEDULE

Session	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I PROBABILITY AND RANDOM VARIABLES			
1.	Probability concepts	Yes	[T1]
2.	Random variables(discrete)	Yes	
3.	Random variables(continuous)	Yes	
4.	Moment (Mean and Variance)	Yes	
5.	Moment generating functions	Yes	
6.	Binomial, poisson	Yes	
7.	Geometric negative binomial	Yes	
8.	Problems	Yes	
9.	Exponential, Gamma	Yes	
10.	Weibull distributions	Yes	
11.	Problems	Yes	
12.	Functions of random variables	Yes	
UNIT II TWO DIMENSIONAL RANDOM VARIABLE			
13.	Marginal and conditional distribution(Discrete)	Yes	[T2]
14.	Marginal and conditional distribution(continuous)	Yes	
15.	Problems	Yes	
16.	Correlation	Yes	

17.	Rank correlation	Yes	
18.	Problems	Yes	
19.	Regressions	Yes	
20.	Conditional expectations	Yes	
21.	Transformation of random variables(addition and subtraction)	Yes	
22.	Transformation of random variables (multiplication and division)	Yes	
23.	Central limit theorem	Yes	
24.	Problems	Yes	

UNIT III   RANDOM PROCESS

25.	Classification	Yes	
26.	WSS	Yes	
27.	stationary and markov process		
28.	stationary and markov chain problems	Yes	
29.	binomial process	Yes	[T3]
30.	poisson process		
31.	Properties of poisson process	Yes	
32.	problems	yes	
33.	Sign wave process	Yes	
34.	Ergodic process	Yes	
35.	Mean Ergodic theorem	Yes	
36.	problems	Yes	

UNIT IV   CORRELATION FUNCTIONS

37.	**Auto correlation for discrete process**	Yes	
38.	**Auto correlation for continuous process**	Yes	
39.	**Properties**	Yes	[T4]
40.	**Problems**	Yes	
41.	**Cross correlation functions**	Yes	
42.	**Problems**	Yes	
43.	Auto covariance	Yes	
44.	Auto correlation of poisson processes	Yes	
45.	Correlation integrals	Yes	
46.	Applications	Yes	
47.	Linear systems with random input	Yes	
48.	problems	Yes	

UNIT V SPECTRAL DENSITIES

49.	Power spectral density	Yes	
50.	Properties	Yes	

51.	Spectral density theorem	Yes	
52.	Problems	Yes	
53.	Relationship between auto correlation and spectral	Yes	
54.	Cross spectral density	Yes	[T5]
55.	Problems	Yes	
56.	Wiener-khinchine theorem	Yes	
57.	Applications to linear system with random inputs	Yes	
58.	problems	Yes	
59.	Unit impulse response of the system	Yes	
60.	Properties and problems	Yes	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures

- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.

- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Assignments/Seminar/online test/quiz	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by: Mr.Krishnakumar , Assoc.Professor   **Dated :**

Addendum

ABET Outcomes expected of graduates of B.Tech / ECE / program by the time that they graduate:

a. An ability to apply knowledge of mathematics, science, and engineering

b. An ability to design and conduct experiments, as well as to analyze and interpret data

c. An ability to design a hardware and software system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

d. An ability to function on multidisciplinary teams

e. An ability to identify, formulate, and solve engineering problems

f. An understanding of professional and ethical responsibility

g. An ability to communicate effectively

h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

i. A recognition of the need for, and an ability to engage in life-long learning

j. A knowledge of contemporary issues

k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Educational Objectives

PEO1: PREPARATION

Electronics Engineering graduates are provided with a strong foundation to passionately apply the fundamental principles of mathematics, science, and engineering knowledge to solve technical problems and also to combine fundamental knowledge of engineering principles with modern techniques to solve realistic, unstructured problems that arise in the field of Engineering and non-engineering efficiently and cost effectively.

PEO2: CORE COMPETENCE

Electronics engineering graduates have proficiency to enhance the skills and experience to apply their engineering knowledge, critical thinking and problem solving abilities in professional engineering practice for a wide variety of technical applications, including the design and usage of modern tools for improvement in the field of Electronics and Communication Engineering.

PEO3: PROFESSIONALISM

Electronics Engineering Graduates will be expected to pursue life-long learning by successfully participating in post graduate or any other professional program for continuous improvement which is a requisite for a successful engineer to become a leader in the work force or educational sector.

PEO4: SKILL

Electronics Engineering Graduates will become skilled in soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, interpersonal relationship, group discussion and leadership ability to become a better professional.

PEO5: ETHICS

Electronics Engineering Graduates are morally boosted to make decisions that are ethical, safe and environmentally-responsible and also to innovate continuously for societal improvement.

Course Teacher	Signature
Mr.Krishnakaumar	

Course Coordinator   **HOD/ECE**