FACULTY OF ENGINEERING

B.E. (ECE) III - Semester (AICTE) (Main & Backlog) (New) Examination,
February / March 2023

Subject: Probability Theory and Stochastic Processes

Time: 3 Hours

Max. Marks: 70

Note: (i) First question is compulsory and answer any four questions from the
remaining six questions. Each Questions carries 14 Marks.

(ii) Answer to each question must be written at one place only and in the
same order as they occur in the question paper.

(iii) Missing data, if any, may be suitably assumed.

1. (a) Define probability and its Axioms of probability.
   (b) State conditional probability.
   (c) In the experiment of tossing a die what is the probability of the face having 3 dots or 6
   dots to appear.
   (d) State uniform random variable along with waveform for cdf.
   (e) State mean and variance for one random variable.
   (f) Write relationship between power spectrum and auto correlation function.
   (g) State wide sense stationary process.

2. (a) State and prove Bayes Theorem.
   (b) Companies b1, b2, b3 produces 30%, 45%, 25% of the car respectively .It is
   know that 2%,3% and 2% of these cars produced from b1,b2,b3 are defective.
   (i) What is the probability that a car purchased is defective. (ii). If a car purchased is
   found to be defective. What is the probability that this car produced by the
   company b1.

3. (a) Discuss the characteristic of Rayleigh, Uniform, Binomial random variable
   using relevant expression and sketches of their distribution and density function.
   (b) Prove the Mean of exponential random variable is E[X]= a+b.

4. (a) Two random variable x and y have a joint probability density function of the
   form $f(x,y) = k(8xy)$: $0 \le x \le 1$ $0 < y < 1$.
   i) Find the value of K ii) Find Expected value E[xy].
   (b) State characteristic function $\Phi(w)$ and its properties.

5. (a) Find the marginal density function of joint density function fxy $(x,y) = e^{x+y} u(x)u(y)$
   and also check whether they are statistically independent
   (b) Write short note on central limit theorem, mutual information, channel capacity.

6. (a) Consider a random process x(t) =A sin(wt+θ) where A and θ are statistical
   independent and θ is uniform in the interval of (0,2π) .Is the process WSS or not ?
   (b) State auto correlation and its properties

7. (a) Write about Linear Transformation of Gaussian Random Variable.
   (b) Find the coefficient of correlation of X and Y from the data given in table. Assume all
   are equal probability element

X	1	2	3	4
Y	2	4	8	10