R17

Code No: R17A0403

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech I Semester Supplementary Examinations, April 2023

Probability Theory and Stochastic Process

(ECE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

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SECTION-I

1 *A* Two coins are tossed 500 times, and we get: **[7M]**
Two heads: 105 times
One head: 275 times
No head: 120 times
Find the probability of each event to occur.

B One card is drawn from a deck of 52 cards, well-shuffled. Calculate the probability that the card will (i) be an ace, (ii) not be an ace **[7M]**

OR

2 *A* Two coins are tossed once. Find a sample space. **[5M]**

B Consider the experiment of rolling a die. Let A be the event 'getting a prime number', B be the event 'getting an odd number'. Write the sets representing the events. **[9M]**

SECTION-II

3 *A* The pdf of a random variable X is given by **[7M]**

$$f_X(x) = \begin{cases} \frac{1}{b} e^{-\left(\frac{x-a}{b}\right)}, & x \geq a \\ 0, & x < a \end{cases}$$

Demonstrate i) mean value E[X] ii) mean square value E[X^2]
iii) variance σ^2

B If the probability density of a random variable is given by **[7M]**

$$f_x(x) = K(1-x^2); 0 < x < 1$$

Solve the value of K and $F_X(x)$.

OR

4 *A* Explain the significance of skew (μ_3) and skewness of single random variable 'X' and interpret the skew μ_3 of uniformly distributed on [a,b]. **[7M]**

B Develop the moment generating function for Gaussian random variable 'X' and show that its mean is m_x and variance is σ_X^2 **[7M]**

SECTION-III

5 *A* Make use of the property of a valid joint probability density function(pdf), find a value of the constant 'b' where the joint pdf **[7M]**

$f_{xy}(x, y) = bxy^2 e^{-2xy} u(x-2)u(y-1)$ is a valid joint probability density.

B The joint density of two random variables X and Y is **[7M]**

$f_{xy}(x,y) = 0.1\delta(x)\delta(y) + 0.12\delta(x-4)\delta(y) + 0.05\delta(x)\delta(y-1) +$
$0.25\delta(x-2)\delta(y-1) + 0.3\delta(x-2)\delta(y-3) + 0.18\delta(x-4)\delta(y-3)$ Simplify
and plot the marginal densities and distributions of X and Y.

OR

6	*A*	Develop the probability density function $\left(f_w(w)\right)$ of sum of two statistically independent random variables $(W = X + Y)$.	[7M]
	B	Inspect about Joint central moments (μ_{nk}) and analyse the various conditions of correlation (R_{XY}) of two random variables X & Y.	[7M]

SECTION-IV

7	*A*	Define Random Process and Explain its classification with neat sketches.	[7M]
	B	Show that the random process X(t)=A cos(ω_0t+θ) is wide sense stationary(WSS), if it is assumed that A & ω_0 are constants and θ is uniformly distributed random variable on the interval [0,2Π].	[7M]

OR

8	*A*	Compare auto-correlation and cross-correlation properties.	[7M]
	B	Determine the average power of the random process, $X(t) = A_0\cos(\omega_0 t + \theta)$, where A_0, ω_0 are real constants and θ is a random variable uniformly distributed on the interval (0,π/2).	[7M]

SECTION-V

9	*A*	Analyse the mean square value of the response of an LTI system having white noise at its input.	[7M]
	B	X(t) be the white Gaussian noise with $S_{XX}(\omega) = \frac{N_0}{2}$. Assume that X(t) is input to an LTI system with $h(t) = e^{-t}u(t)$, Y(t) be the output then Determine the following: (i) $S_{YY}(\omega)$ (ii) $R_{YY}(\tau)$ (iii) $E[y^2(t)]$	[7M]

OR

10	*A*	Determine the cross-correlation function corresponding to the cross-power density spectrum $S_{XY}(\omega) = \frac{8}{(\alpha + j\omega)^3}$, where α>0 is a constant.	[7M]
	B	Find the noise bandwidth of a system having the power transfer function $\lvert H(\omega)\rvert^2 = \frac{1}{\left[1+\left(\frac{\omega}{\omega_0}\right)^4\right]}$ Where ω_0 is a real constant and |H (0)|=1.	[7M]

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