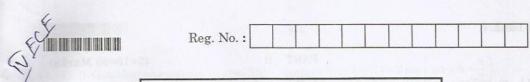
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Question Paper Code: 41312

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018 Fourth Semester

Electronics and Communication Engineering
MA 6451 – PROBABILITY AND RANDOM PROCESSES

(Common to Biomedical Engineering, Robotics and Automation Engineering)
(Regulations 2013)

Time: Three Hours Maximum: 100 Marks

Answer ALL questions

PART - A (10×2=20 Marks)

1. If $f(x) = \frac{x^2}{3}$, -1 < x < 2 is the pdf of the random variable X, then find P[0 < x < 1].

- 2. Messages arrive at a switchboard in a Poisson manner at an average rate of six per hour. Find the probability for exactly two messages arrive within one hour.
- 3. If X and Y are random variables having the joint density function $f(x, y) = \frac{1}{8}(6 x y)$, 0 < x < 2, 2 < y < 4, then find P[X + Y < 3].
- 4. Find the acute angle between the two lines of regression.
- 5. Define Markov process.
- 6. State any two properties of Poisson process.
- 7. Find the mean square value of the random process $\{X(t)\}$ if its autocorrelation function $R(\tau)=25+\frac{4}{1+6\tau^2}$.
- 8. Write any two properties of the power spectral density of the WSS process.
- 9. Prove that the mean of the output process is the convolution of the mean of the input process and the impulse response.
- 10. Assume that the input X(t) to a linear time-invariant system is white noise. What is the power spectral density of the output process Y(t) if the system response $H(\omega) = 1$, $\omega_1 < |\omega| < \omega_2$ is given?

 = 0, otherwise

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				PART – B		(5×16=80 M		VA
11. a)	i) For a un generat	niform ra ing funct	ndom vari	able X in the	interval (a, b) s mean and va), derive the momen	A	V
ii	i) Let X be	the rand	dom varial	ole that deno I variance of	tes the outcom	ne of the roll of a fa		
		((OR)				(6)	
			c compate	the first lou	r moments.	tion with parameter	(10)	•
ii) A contir	uous rai	ndom vari	able X has t	he density fu	nction f(x) given b	(10)	
	$f(x) = \frac{1}{x^2}$	$\frac{k}{1+1}$, $-\infty$	< x < ∞. Fi	nd the value o	of k and the cur	nulative distribution	n	
	of X.						(6)	
12. a) G	Given f(x,	$y) = \frac{1}{8} (x - \frac{1}{8})$	y , $0 \le x$	$\leq 2, 0 \leq y \leq 2$	is the joint pd	f of X and Y. Obtain	n	
tl	he correlat	ion coeffi	cient betw	een X and Y				
			R)					
	$y \ge 0$. Fir	nd the pro	robability bability d	density functi ensity functi	tion $f(x, y) = 4$ on of $\sqrt{X^2 + Y^2}$	us random variable $\frac{1}{2}$ $\frac{1}{$	(10)	
3. a) i)	Prove tha	at Poissor	n process i	s a Markov p	rocess.		(8)	
ii)	A randon where A a	n process and B are	{X(t)} is dindependen	efined by X(intrandom var	$t) = A \cos t + E$	$3 ext{ sintt}, -\infty < t < \infty,$ which has a value -2		
	not statio	namin a	trict sense	arde I with p	robability	Show that {X(t)} is		
	and Budge	(0)		•			(8)	
	The state of the s	and $\{X_2(s,\lambda_1)\}$	t)} represe	very, then more	To that DIX (+) -	son processes with $x/\{X_1(t) + X_2(t) = n\}$		
	is binomia	al with pa	arameters	n and p, whe	$p = \frac{\lambda_1}{\lambda_1 + \lambda_2}$	The anison that	(10)	
11)	Consider and ω are	a randon constant	process {	X(t)) such th	at X(t) = A cos	s ($\omega t + \theta$), where A le distributed with ationary process in		
	outs						(6)	
								-

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41312 14. a) i) Consider two random processes $X(t) = 3\cos(\omega t + \theta)$ and $Y(t) = 2\cos(\omega t + \theta - \frac{\pi}{2})$, where θ is a random variable uniformly distributed in $(0, 2\pi)$. Prove that $\sqrt{R_{XX}(0)} R_{YY}(0) \ge |R_{XY}(\tau)|$. (10)ii) Determine the autocorrelation function of the random process with the power spectral density given by $S_{XX}(\omega) = S_0$, $|\omega| < \omega_0$. (OR) b) i) Given that a process {X(t)} has the autocorrelation function $R_{XX}(\tau) = Ae^{-\alpha - |\tau|} \cos(\omega_0 \tau)$ where A > 0, $\alpha > 0$ and ω_0 are real constants, find (8) the power spectrum of X(t). ii) The cross-power spectrum of real random processes X(t) and Y(t) is given by $S_{XY}(\omega) = a + jb\omega$, $|\omega| < 1$. Find the cross-correlation function. 15. a) i) Show that $S_{YY}(\omega) = |H(\omega)|^2 S_{XX}(\omega)$, where $S_{XX}(\omega)$ and $S_{YY}(\omega)$ are the power spectral density functions of the input X(t) and the output Y(t) and H(w) is the system transfer function. ii) Obtain the power spectral density function of the output process {Y(t)} corresponding to the input process {X(t)} is the system that has an impulse response $h(t) = e^{-\beta t} U(t)$. (OR) b) A random process X(t) is the input to a linear system whose impulse response is $h(t) = 2e^{-t}$, $t \ge 0$. If the autocorrelation function of the process is $R_{XX}(\tau) = e^{-2|\tau|}$, determine the following: The cross correlation function between the input process X(t) and the output process Y(t).