Name :
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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

07 THRISSUR CLUSTER

FIRST SEMESTER M.TECH. DEGREE EXAMINATION DEC 2017

Department of Electronics and communication Engineering

Applied Electronics And Communication System

07MA 6013 MATHEMATICS FOR COMMUNICATION ENGINEERING

Time : 3 hours **Max.Marks: 60**

Answer all six questions. Part 'a' of each question is compulsory.

Answer either part 'b' or part 'c' of each question

Q.no.	Module 1	Marks
1a	[Find the moment generating function of X with probability function $P(X=x) = \frac{1}{2^x}, x = 1,2,3..$	4
	Answer b or c	
b	The joint probability function of X and Y is $f(x,y) = \begin{cases} ke^{-(x+y)}, & 0 < y < x < \infty \\ 0, & otherwise \end{cases}$. Find (i) value of k (ii) the conditional density function $f(x/y)$ and (iii) $P(Y \geq 3)$.	5
c	Given the joint pdf of X and Y as $f(x,y) = \begin{cases} 8xy, 0 < x < y < 1 \\ 0, otherwise \end{cases}$ Check whether X and Y are independent. Also find $P(X < \frac{1}{2} \cap Y < \frac{1}{4})$.	5

Q.no.	Module 2	Marks
2a	Define a stochastic process and its finite dimensional marginal distribution. Give an example of a stochastic process.	4
	Answer b or c	
b	If X and Y have the joint density function $f(x,y) = \begin{cases} e^{-(x+y)} & ; x \geq 0, y \geq 0 \\ 0 & ; otherwise \end{cases}$ Find the joint density function of U=X/Y and V=X+Y.	5
c	Given the joint pdf of X and Y as $f(x,y) = \begin{cases} x+y \; ; & 0 \leq x \leq 1, 0 \leq y \leq 1 \\ 0 \; ; & otherwise \end{cases}$ Find the conditional expectation and conditional variance of Y given X.	5

Q.no.	Module 3	Marks
3a	Find all solutions of y+z-2w=0 , 2x-3y-3z+6w=2 , 4x+y+z-2w=4.	4
	Answer b or c	
b	Define basis and dimension of a vector space. Examine whether S= {(1,2,1),(2,1,0),(1,-1,2)}is a basis for R^3(R).	5
c	Use Gram-Schmidt process to construct an orthonormal basis for R^3(R) From the basis B= {(2, 4,-4),(-3,6,0),(7,2,1)}.	5

Q.no.	Module 4	Marks
4a	Find the matrix of the linear transformation $T:R^3 \rightarrow R^2$; $T(x,y,z)=(x+2y-z,-x+3y+z)$ Relative to the bases, $B_1=\{(1,-2,3),(-2,-2,0),(1,-1,1)\}$ and $B_2=\{(1,2),(2,3)\}$.	4
	Answer b or c	
b	Determine the nature of the quadratic form $10x^2+2y^2+5z^2+6yz-10zx-4xy$.	5
c	Find the rank and nullity of the linear transformation $T:R^2 \rightarrow R^3$ defined by $T(x, y) =(x+ y, x-y, y)$.	5

Q.no.	Module 5	Marks
5a	Explain birth and death processes.	5
	Answer b or c	
b	Evaluate P(2),P(3),.....P(10) for the homogeneous Markov chain given by the transition probability matrix $P(1)=\begin{bmatrix} 0.1 & 0.6 & 0.3 \\ 0.5 & 0.1 & 0.4 \\ 0.1 & 0.2 & 0.7 \end{bmatrix}$ Find also the probabilities of each state in every step transition. Assume that the initial probabilities of the states as 0.5, 0.3 and 0.2 respectively.	7
c	Find the steady state probabilities of the Markov chain with transition Probability matrix	7

Q.no.	Module 6	Marks
6a	Prove that $X(t) = A\cos\omega t+B\sin\omega t$, where A and B are independent random variables such that $E(A)=E(B)=0$; $E(A^2)=E(B^2)$, is a wide sense stationary process.	5
	Answer b or c	
b	Describe the following-(i) White noise and white noise integrals (ii) Linear filtering.	7
c	The process $X(t) =N(t)-\lambda t$ where $\{N(t)\}$ is a Poisson process of parameter λ is wide sense stationary. Prove or disprove.	7