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	Examine whether the set of vectors is a basis of R^3,S={$x_1 = (1,2,3), x_2 =$ *2,3,4,x3=3,4,5*	4
	Answer b or c	
b	Solve the system of equations ,x+y+z=3,x+2y+3z=4,x+4y+9z=6	5
c	Given the basis $\{P_1(t) = 1, P_2(t) = t, P_3(t) = t^2\}\ of\ P_2(t)$	5

Q.no.	Module 2	Marks
2a	Find a linear transformation T : $R^2 \to R^2$ such that T(2,3)=(4,5) and T(1,2)=(-1,-1)	4
	Answer b or c	
b	Find a basis for the kernel of the linear transformation T : $R^3 \to R^3$ defined by T(x_1, x_2, x_3)=($x_1 + x_2$+$2x_3, x_1 + 2x_2$+$5x_3, 5x_1 + 3x_2$+$4x_3$).Is T one to one onto?	5
c	Find the Eigen values and Eigen vectors of the matrix $\begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 0 \\ 0 & 0 & 5 \end{bmatrix}$	5

Q.no.	Module 3	Marks
3a	Find the mean and variance of the random variable X by means of moments with the p.d.f given by $f(x) = kx^2e^{-x}, x \geq 0$.	4
	Answer b or c	
b	The joint p.d.f of the random variable (X,Y) is given by	5

$f(x,y) = kxye^{-(x^2+y^2)}, x > 0, y > 0$.Prove that X and Y are independent.

c The joint p.d.f of a 2-dimensional random variable (X,Y) is given by $f(x,y) = xy^2 + \frac{x^2}{8}, 0 \leq x \leq 2, 0 \leq y \leq 1$.Compute$P[X > 1]$, P $\left[Y < \frac{1}{2}\right]$,P$\left[X > 1/Y <\right.$ $12,$P$Y<12/X>1$ **5**

Q.no. **Module 4** **Marks**

4a The joint p.d.f of (X,Y) is given by $f(x,y) = 24xy, x > 0, y > 0, x + y \leq 1$.Find $E(Y/X)$ and $V(Y/X)$ **4**

Answer b or c

b Define stochastic process. Classify the general stochastic process. **5**

c If X and Y are independent random variables with p.d.f as $f_X = e^{-x}, x \geq 0$ and $f_Y = e^{-y}, y \geq 0$,find the probability distribution function of $U = \frac{X}{X+Y}$ and $V = X + Y$.Are they independent? **5**

Q.no. **Module 5** **Marks**

5a Show that the process $X(t) = A\cos\lambda t + B\sin\lambda t$ (where A and B are random variables) is WSS if **5**

(1) $E(A) = E(B) = 0$
(2) $E(A^2) = E(B^2)$
(3) $E(AB) = 0$

Answer b or c

b Define white noise and white noise integrals, linear predictions and linear filtering **7**

c If $X(t) = A\cos(w_0 t + \theta)$,where A and w_0 are constants and θ is uniformly distributed over (0,2π),find the auto correlation function and power spectral density of the process. **7**

Q.no. **Module 6** **Marks**

6a Assume that a computer system is in any one of the 3 states, busy ,idle ,.and under repair respectively denoted by 0,1,2.Observing its state at 2p.m each day we get the TPM as P=$\begin{bmatrix} 0.6 & 0.2 & 0.2 \\ 0.1 & 0.8 & 0.1 \\ 0.6 & 0 & 0.4 \end{bmatrix}$ .Find out third step TPM.Determine the limiting probabilities. **5**

Answer b or c

b Three boys A,B,C are throwing a ball to each other. A always throw the ball to B and B always throw the ball to C, but C is as likely to throw the ball to B as to **7**

A. Show that the process is markovian. Find TPM and classify the states.

c Define Poisson random process. Is it stationary process? Prove that the Poisson process holds following probabilities **7**

(1) The Poisson process is a Markovian process

(2) Sum of two independent Poisson process is a Poisson process.

(Note: The sub question 'a' will be compulsory one, testing the knowledge on fundamental aspects. Parts 'b' and 'c' shall preferably be application type questions with the choice to answer any one.)