APJ ABDULKALAM TECHNOLOGICAL UNIVERSITY

08 PALAKKAD CLUSTER

Name: ....

Q. P. Code : CESP0820111-I (Pages: 3)

Reg. No:..

FIRST SEMESTER M.TECH. DEGREE EXAMINATION MARCH 2021

Branch: Electronics &Communication Engineering

Specialization: Communication Engineering & Signal Processing

08EC6211/08EC6511 Mathematics for Communication Engineering

(Common to CESP and ECE)

Time: 2 hour 15 minutes **Max. Marks: 60**

Answer all six questions.

Modules 1 to 6: Part 'a' of each question is compulsory and answer either part 'b' or part 'c' of each question.

Q. No.	Module 1	Marks
1.a	Determine whether the vectors (1,3,2,-2), (4,1,-1,3) , (1,1,2,0) and (0,0,0,1) are linearly independent or not .	3
	Answer b or c	
b	Find the basis and dimension of the subspace W of R^4 generated by (1,2,-1,3), (2,1,-1,1) and (-1,4,5,11).	6
c	Using Gram Schmidt orthogonalization process find an orthonormal basis for the subspace spanned by the vectors (1, 1,1) (-1 ,0, -1) (-1,2, 3) of R^3.	6

Q. No.	Module 2	Marks
2.a	Show that the map $T:R^2 \rightarrow R^3$ defined by T(a,b) = (a+b, a-b, b) is a linear Transformation.	3
	Answer b or c	
b	Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$	6
c	Find a basis for the range of the linear transformation $T:R^3 \rightarrow R^3$ defined by $T(x_1,x_2,x_3) = (x_1+x_2+2x_3,\ x_1+2x_2+5x_3,\ 5x_1+3x_2+4x_3)$.	6

Q. No.	Module 3	Marks
3.a	Let X be a random variable with m.g.f$M_x(t)$ then show that $M_{ax+b}(t) = e^{bt}M_X(at)$.	3
	Answer b or c	
b	The random variables X and Y have joint distribution function $f(x,y) = \begin{cases} x^2 + \frac{xy}{3} & ,0 < x < 1, 0 < y < 2 \\ 0, elsewhere \end{cases}$. Find 1) Marginal density function of X and Y 2) Are X and Y independent?	6
c	The density function of a two dimensional random variable (X,Y) is given by F (x,y) = $\{e^{-(x+y)}, x > 0, y > 0\}$.Check whether X and Y are independent.	6

Q. No.	Module 4	Marks
4.a	A student study habits are as follows.If he studies one night,he is 70% sure not to study next night.On the other hand, the prob.that he does not study 2 nights in succession is 0.6.In the long run ,how often does he study?	3
	Answer b or c	
b	A Markov chain on state space {1,2,3} has initial distribution $p(X_0=i)=1/3$ and TPM = $\begin{bmatrix} .1 & .5 & .4 \\ .6 & .2 & .2 \\ .3 & .4 & .3 \end{bmatrix}$ Find a) $P(X_2= 3)$ b) $P(X_4=2/X_2=1)$ c) $P(X_1=1,X_2=2.X_3=3)$	6
c	A message transmission system is found to be Markovian with the transition probability of current message to next message is given by the matrix $\begin{bmatrix} 0.2 & .0.3 & 0.5 \\ 0.1 & 0.2 & 0.7 \\ 0.6 & 0.3 & 0.1 \end{bmatrix}$ The initial probabilities of the states are p1(0)=0.4, p2(0)=0.3, p3(0)=0.3. Find the probabilities of the next message	6

Q. No.	Module 5	Marks
5.a	If people arrive at a book stall in accordance with a Poisson Process with a mean rate of 3 per minute,find the probability that the interval betweentwo consecutive arrivals is 1) more than 1 minute 2) between 1 min and 2 min 3) 4 min or less.	4
	Answer b or c	
b	A random process X(t) is defined as X(t) = 2cos $(5t+\theta)$ where θ is uniformly distributed in $[0,2\pi]$. Find mean and autocorrelation.	8
c	A man either drives a car or catches a train to go to office each day. He never goes 2 days in a raw by train but if he drives one day .then the next day he is just as likely to drive again as he is to travel by train . Now suppose that on the first day of the week the man tossed a fair die and drove to work if 6 appeared. Find (i) The probability that he takes a train on the 3^{rd} day. (ii) The probability that he drives to work in the long run	8

Q. No.	Module 6	Marks
6.a	Find the power spectral density of the WSS random process with autocorrelation function $2e^{-T} + 4e^{-4T}$.	4
	Answer b or c	
b	Consider the random process X(t) = cos $(t+\theta)$ where θ is a random variable with density function $f(\theta) = 1/\pi, (-\pi/2<\theta<\pi/2)$. Check whether the process is stationary or not.	8
c	Given a random variable y with characteristic function $\phi(\omega) = E[e^{i\omega y}]$ and random process defined by $X(t) = \cos(\lambda t + y)$.Show that $X(t)$ is a stationary in wide sense of $\phi(1) = \phi(2) = 0$.	8