CBCS SCHEME

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21EC33

Third Semester B.E. Degree Examination, June/July 2024
Basic Signal Processing

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Show that : W is a subspace of V(F) iff.
i) W is none empty
ii)$\forall$ a, b, $\in$ F and V_1 W $\in$ W, [av + b.w] $\in$ W. **(06 Marks)**

b. Determine whether or not each f the following form a basis x_1 = (2, 2, 1) ; x_2(1, 3, 1), x_3 = (1, 2, 2) in R^3. **(06 Marks)**

c. Evaluate u, v, w, are pair wise orthogonal vectors and find orthonormal vectors of

$$u = \begin{bmatrix} 1 \\ 2 \\ 2 \end{bmatrix}, v = \begin{bmatrix} 2 \\ -2 \\ 1 \end{bmatrix}, w = \begin{bmatrix} 2 \\ 1 \\ -2 \end{bmatrix}.$$ **(08 Marks)**

OR

2 a. Define vector subspace and explain the four fundamental subspace. **(06 Marks)**

b. Determine the linear transformation of 'T' from $R^2 \to R^2$ such that
T(1, 0) = (1, 1) and T(0, 1 = (–1, 2). **(06 Marks)**

c. Apply Gram – Schemidt process to vectors, V_1= (1, 1, 1), V_2 = (1, -1, 2), V_3 = (2, 1, 2) to obtain on orthonormal basis for V_3® with the standard inmer product. **(08 Marks)**

Module-2

3 a. Evaluate Eigen values and eigen vector for matrix :

$$A = \begin{bmatrix} -2 & 2 & 3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}.$$ **(10 Marks)**

b. Factorize the matrix A into A = $U\Sigma V^T$ using single value decomposition :

$$A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \\ -1 & 1 \end{bmatrix}.$$ **(10 Marks)**

OR

4 a. Diagonalize the matrix :

$$A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}.$$ **(10 Marks)**

Find an invertible matrix D and diagonal matrix D such that D = PAP^{-1}. **(06 Marks)**

b. Define positive definite matrix mention the methods of testing positive definite. **(04 Marks)**

c. Determine eigen values and eigen vectors for

$$A = \begin{bmatrix} 1 & -1 \\ 2 & 4 \end{bmatrix}.$$

Module-3

5 a. Find and sketch : i) $y_1(n) = x(4 - n)$ ii) $y_2(n) = x(2n - 3)$ for given $x(n) = [u(n) - u(n) - 8)]$. **(07 Marks)**

b. Obtain whether the givne system is linear, time invariance, memory causal :
i) $y_1(n) = n^2x(n - 1)$, ii) $y_2(n) = \log_{10}[x(n)]$. **(08 Marks)**

c. Describe the elementary signals. **(05 Marks)**

OR

6 a. Sketch : i) $Z(n) = x(2n)y(n - 4)$, given the signals x(n) and y(n) in the Fig.Q6(a).

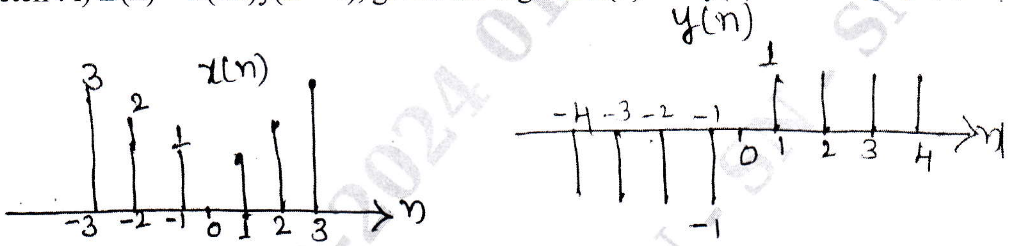

Fig.Q6(a) **(07 Marks)**

b. Check whether the following system is linear time invariance, memory causal.
i) $y(n) = x(n) + 2x^2(n)$, ii) $y(n) = g(n)x(n)$. **(08 Marks)**

c. What is system? Explain its properties. **(05 Marks)**

Module-4

7 a. Evaluate $y(n) = x(n) * h(n)$. If $x(n) = \alpha^n u(n)$. $\alpha < 1$ and $h(n) = u(n)$. **(06 Marks)**

b. Evaluate the step responses for the LTI system represented by the following impulse response : i) $h(n) = (1/2)^n u(n)$, ii) $h(n) = u(n)$. **(06 Marks)**

c. Check whether given LTI system is stable, causal and compute the h(n) for the sequence.
$y(n) = x(n + 1) + 5x(n) - 7x(n - 1) + 4x(n - 2)$. **(08 Marks)**

OR

8 a. Evaluate the discrete time convolution sum $y(n) = (1/2)^n u(n - 2) * u(n)$. **(10 Marks)**

b. Check whether the following system is memoryless, causal, stable
i) $h(n) = e^{2n}u(n - 1)$ ii) $h(n) = 2u(n) - 2u(n - 1)$. **(10 Marks)**

Module-5

9 a. State and prove the Differentiation in Z – domain in Z – Transformation. **(05 Marks)**

b. Evaluate Z – Transform of given $x(n) = n\left(\frac{1}{2}\right)^n u(n)$. **(08 Marks)**

c. Obtain Inverse Z – Transformation of given

$$X(Z) = \frac{-1 + 5z^{-1}}{1 - \frac{3}{2}Z^{-1} + \frac{1}{2}Z^{-2}} \quad \text{ROC } |Z| > 1.$$ **(07 Marks)**

OR

10 a. Compute H(z) and h(n) for LTI system is described by

$$y(n) - \frac{1}{4}y(n-1) - \frac{3}{8}y(n-2) = -x(n) + 2x(n-1)$$ **(08 Marks)**

b. Obtain Z – Transformation of signal. **(07 Marks)**

$$x(n) = 7\left(\frac{1}{3}\right)^n u(n) - 6\left(\frac{1}{2}\right)^n u(n).$$

c. What is ROC and list out the properties? **(05 Marks)**

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