University of Engineering & Management, Kolkata

Term - II Examination, October - November, 2021

Programme Name: B.Tech in Computer Science **Semester: 5th**

Paper Name: Signals & Systems

Paper Code: ESC501

Full Marks: 100 **Time: 3 hours**

GROUP A (20 Marks)

Answer the following questions. Each question is of 2 marks.

1.

(i) State the convolution property of z-transform.
(ii) Define Final value theorem of Laplace transform
(iii) Explain the convolution property of z-transform.
(iv) What is meant by impulse response of any system?
(v) Give synthesis and analysis equations of CT Fourier Transform
(vi) What is an anti–aliasing filter?
(vii) Explain sampling frequency.
(viii) What is over sampling?
(ix) What is the role of zero padding in DFT based signal analysis?
(x) What is zero order hold?

GROUP B (30 Marks)

Answer the following questions. Each question is of 5 marks.

2. Find the z-transform of the causal sequence. X(n) = {1,0,3,-1,2}.
3. Prove the linearity property of Laplace Transform.

4. Find the Laplace transform of the function $\boxed{x(t) = e^{-5t}[u(t) - u(t-5)]}$
5. **A**. Explain the problems with related to ideal Low Pass Filter.

OR

B.Write the complex form of a Fourier Series f(x) defined in the interval (c, c+2l).

6. **A**. Explain the complete process of reconstruction of a Band-limited signal using ideal low pass filter.

OR

B. Explain the Frequency Domain representation of a sampled signal.

7. A. Explain Dirichelt's conditions for a function to be expanded as a Fourier Series.

OR

B. Given a continuous-time signal x(t) with Nyquist rate ω_0 . Determine the Nyquist ratefor the continuous time signal $x^2(t)$.

GROUP C (50 Marks)

Answer the following questions. Each question is of 10 marks.

8. A. Find the initial value of the z transform $\boxed{X(z) = \frac{3z+4}{(z-1)(z+1)}}$

OR

B. Consider the signal x(t)=[cos t + sin t + cos t sin t]. Find the even and odd component of the signal x(t).

9. Explain the following operations on signals with suitable example.
i) Time shifting
ii) Time scaling
iii)Time reversal
iv) Signal addition

10. A. From the given impulse response h(n) of the system, find whether the systems are causal and stable i) $\boxed{h(n) = 2^n u(-n)}$ ii) $\boxed{h(n) = 5^n u(3-n)}$

OR

10. B. Describe the relation between DFT to Fourier Series

OR

ii) Find the DTFT of the discrete sequence x(n)={1,1,1,1,1,1,0,0}

11. A.Write the complex form of a Fourier Series f(x) defined in the interval (c, c+2l)

OR

B.Find the z transform of the signal x(n)= u(n)-u(n-4)

12. A. Demonstrate the sampling theorem and the sinc interpolation formula for the signal

$$f(t) = \text{sinc}^2(5\pi t) = \text{sinc}^2\left(\frac{10\pi t}{2}\right).$$

OR

B. Explain Nyquist rate. Then explain and prove the condition of oversampling

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