



University of Engineering & Management, Kolkata

End Semester Examination, January, 2022

Programme Name: B.Tech in CSE/CST/CSIT Semester: 5th

Course Name: Signals & Systems

Course Code: ESC501

Full Marks: 100

Time: 3 Hours

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**GROUP – A (20 marks)**

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

10 x 2 = 20

1. i) Explain even and odd signals with help of examples.  
ii) Determine the power of the signal:  
$$x(t) = 5 \cos(50t + \frac{\pi}{3})$$
  
iii) What is LTI system?  
iv) Determine the system described below is static or not:  
$$y(t) = 5 \cos[x(t + 2)]$$
  
v) State Parseval's power theorem.  
vi) What is meant by impulse response of any system?  
vii) State the convolution property of z-transform.  
viii) Find the Laplace transform of the system :  $x(t) = u(t - t_0)$   
ix) Explain the main cause of aliasing distortion observed in frequency domain in sampling of a continuous time signal.  
x) What is zero order hold?

**GROUP – B (30 marks)**

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

6 x 5 = 30

2. State various properties of convolution.
3. Find the Laplace transform of the function  
$$x(t) = e^{-at} \sin \omega_0 t$$
4. Determine the Nyquist sampling rate and Nyquist sampling interval for the signal.  
$$x(t) = \sin c^2(200 \pi t).$$
5. A. Determine the period of the signal expressed as  $x(t) = 3 \cos(5t + \pi/6)$ .  
OR  
B. Check the following system is causal or not :  $y(n) = x(n) + 1/x(n-1)$

6. A. State the properties of impulse signals.

**OR**

- B. Find whether the following system with impulse response is stable or not:

$$h(t) = e^{-2|t|}$$

7. A. State and prove properties of DTFT.

**OR**

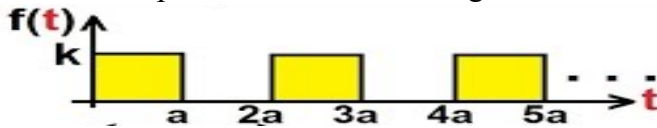
- B. Prove the duality property of Fourier Transform.

**GROUP - C (50 Marks)**

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

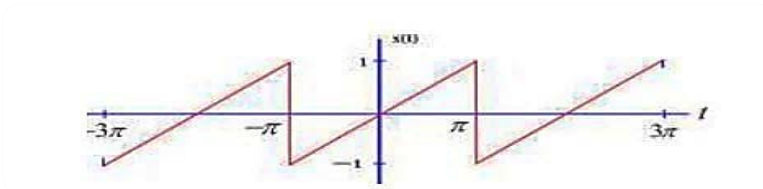
5 x 10 = 50

8. Find the Laplace transform of the signal



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

10. A. Obtain the trigonometric Fourier series representation of the waveform shown below



**OR**

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

5 + 5

- ii) Find the Fourier Series of  $f(x) = x + x^2$  in  $(-\pi, \pi)$

11. A. i) Check the periodicity of the given signal. Find the fundamental period if it is periodic.

5 + 5

$$x(t) = 10 \sin 25\pi t + \cos 10\pi t$$

- ii) Determine whether the system given by the following expression is time invariant or not

$$2 \frac{dy(t)}{dt} + 2ty(t) = 3x(t)$$

**OR**

- B. Draw the waveforms of the following expression stepsize.

$$f_1(t) = u(2 - t)$$

$$f_2(t) = r(n)$$

12. A. i) State the condition for periodicity of a signal.

5 + 5

ii) Check the periodicity of the given signal. Find the fundamental period if it is periodic.

$$x(t) = 10 \sin 25\pi t + \cos 10\pi t$$

**OR**

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

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