INTERNATIONAL CENTRE FOR APPLIED SCIENCES
MAHE, MANIPAL
B.Sc. (Applied Sciences) in Engg.
End – Semester Theory Examinations – May 2021
IV SEMESTER- SIGNALS AND SIGNAL PROCESSING [IEE 241]
(BRANCH: CSE, E & E, MECHATRONICS)

Time: 3 Hours **Date: 21 May 2021** **Max. Marks: 50**

- ✓ **Answer ALL Questions.**
- ✓ **Missing data, if any, may be suitably assumed.**

1A For the signal depicted in Fig.1, sketch the signals **(4)**

a) $x(-t)$
b) $x(t+6)$
c) $x(3t)$
d) $x\left(\frac{t}{2}\right)$

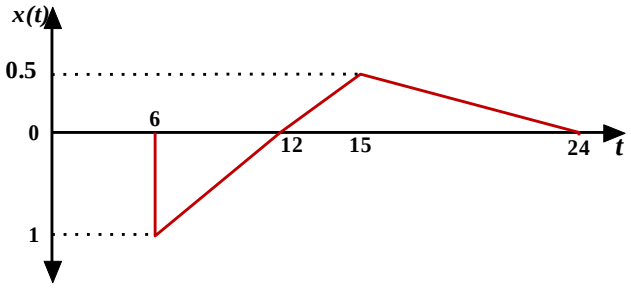

Fig.1

1B Categorize the following signal as an Energy or Power signal and find the energy or power of the signal. **(3)**

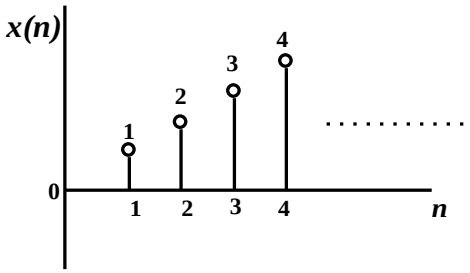

Fig.2

1C Using properties, find the DTFT $X(e^{j\Omega})$of the signal $x(n) = \frac{\sin\left(\frac{\pi}{2}n\right)}{\pi n} * \frac{\sin(\frac{\pi}{2}(n-4))}{\pi(n-4)}$. **(3)**

2A Find the Z transform of the sequence $x(n) = 3^{|n|}$.Also mention its ROC. **(3)**

2B Find the Z transform of $x(n) = n^2a^n$ for $n \geq 0$ using properties and table of transforms. **(2)**

2C For the system with input $x(n)$ and output $y(n)$ determine whether it is

(i) Memoryless
(ii) stable
(iii) Causal
(iv) Linear
(v) Time invariant

$y(n) = 2x(n)u(n)$ **(5)**

3A Find the response of the system $y(n)$ if the impulse response is $h(t) = u(t+3)$ and the input is $x(t) = e^{-3t}$. **(5)**

3B For the periodic signal in Fig.3, find the exponential Fourier series and sketch the corresponding magnitude and phase spectra. **(5)**

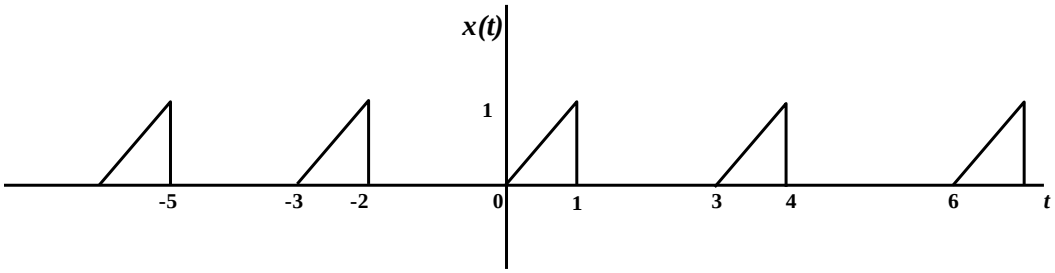

Fig.3

4A A stable LTI system is specified by the frequency response $H(\omega) = \frac{-1}{j\omega - 2}$.Find the impulse response of the system if the input $x(t) = e^{-t}u(t)$. **(3)**

4B Using properties find the Fourier Transform of the following signals. **(2)**

a) $x(t) = e^{-t}u(t) + 2e^{-5|t|}$

b) $x(t) = e^{-2(t-3)}u(t-3)$

4C Find the inverse CTFT of $X(\omega) = \frac{j\omega+3}{(j\omega+1)^2}$. **(5)**

5A A first order discrete time system is characterized by the difference equation $y(n) = x(n) + 0.25y(n-1)$. Obtain the frequency response $H(\Omega)$ and plot the magnitude and phase response. **(6)**

5B Determine whether the following signals are periodic. If they are periodic find the fundamental period. **(4)**

(a) $x(t) = \cos(6t) + \sin(9t)$

(b) $x(n) = \cos\left(\frac{\pi n}{5}\right)\sin\left(\frac{\pi n}{3}\right)$