

Roll No.:.....

National Institute of Technology, Hamirpur (HP)

Name of the Examination: B.Tech. EE (End Semester Examination)			
Branch	: Electrical Engineering	Semester	: 5 th
Course Name	: Signals and Systems	Course Code	: EED – 313
Time	: 2 Hours	Max. Marks	: 50

Note:

- (i) Attempt all the questions. All parts of a given question should be attempted in continuation.
 - (ii) Assume any missing data while making suitable explanation for the choice made.
 - (iii) Show all the underlying steps in a systematic manner, wherever required.
 - (iv) Write your Name, Roll No., Subject Code & Subject Name on first sheet of answer-sheet and put your signature and date on all the sheets at the bottom.
 - (v) The scanned answer-sheets as a **single file with file name xxxxxxEED313.pdf** where xxxxxx represents Roll Number should be uploaded within 15 minutes after completion of examination on **google classroom**.
 - (vi) Delay in submission of answer-sheet may lead to deduction in marks or rejection of answer sheet.
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Q. No.1: Evaluate convolution of following sequences and also show the plot of resulting sequence:

$$x(n) = \left(\frac{1}{3}\right)^{-n} \cdot u(-n - 1) \quad \& \quad h(n) = u(n - 1) \tag{6}$$

Q. No.2: Find out whether the following system is (i) Causal or Non-causal; (ii) Linear or Nonlinear; (iii) Stable or Unstable and (iv) Time Varying or Time Invariant in nature:

$$y(n) = \sin\left\{2\pi \frac{f}{f_s} n\right\} \cdot x(n) \tag{6}$$

Q. No.3: A CT LTI system is characterized by impulse response given as

$$h(t) = e^{-2t} \cdot u(t).$$

If the system is excited by input given as $x(t) = u(t - 3) - u(t - 5)$; then find out the output of the system using convolution.

(6)

Q. No.4: Find out the exponential form of Fourier series for a periodic signal which repeats after every 1 second and is given as

$$x(t) = t; 0 \leq t \leq 1.$$

Also derive the trigonometric Fourier series from the obtained exponential series.

(6)

Q. No.5: Consider the following two discrete time signals with fundamental period of $N=6$:

$$x_1(n) = 1 + \cos\left(\frac{2\pi}{6}n\right) \quad \& \quad y_1(n) = \sin\left(\frac{2\pi}{6}n + \frac{\pi}{3}\right)$$

Determine the Fourier series coefficients for above two signals and use the result to obtain Fourier series coefficients for $z_1(n) = x_1(n) \cdot y_1(n)$.

(6)

Q. No.6: Let a signal $x(t)$ has Fourier Transform given as follows:

$$X(\omega) = \delta(\omega) + \delta(\omega - \pi) + \delta(\omega - 4)$$

and let impulse response is given as $h(t) = u(t) - u(t - 2)$. Check if $x(t)$ is periodic? Also find whether $y(t) = x(t) * h(t)$ is periodic or not ? (Here * represents convolution)

(6)

Q. No.7: Consider a causal LTI System that is characterized by the following difference equation:

$$y[n] = \frac{3}{4}y[n - 1] - \frac{1}{8}y[n - 2] + 2x[n].$$

Find the frequency response and corresponding impulse response of the system. Also find out the response of the system if input is given as $x[n] = \left(\frac{1}{5}\right)^n \cdot u(n)$.

(6)

Q. No.8: (a) Explain Gibbs Phenomenon for periodic signals with discontinuities?

(b) Find out Nyquist rate and Nyquist sampling interval for the following signal:

$$x_1(n) = \sin(200\pi t) + 2 \cdot \cos(400\pi t) - 3 \sin(800\pi t).$$

Also compute the corresponding discrete time signals if sampling is done at (i) 400 Hz and (ii) 800Hz. Comment on the result.

3+5=(8)

=====***** All the Best *****=====